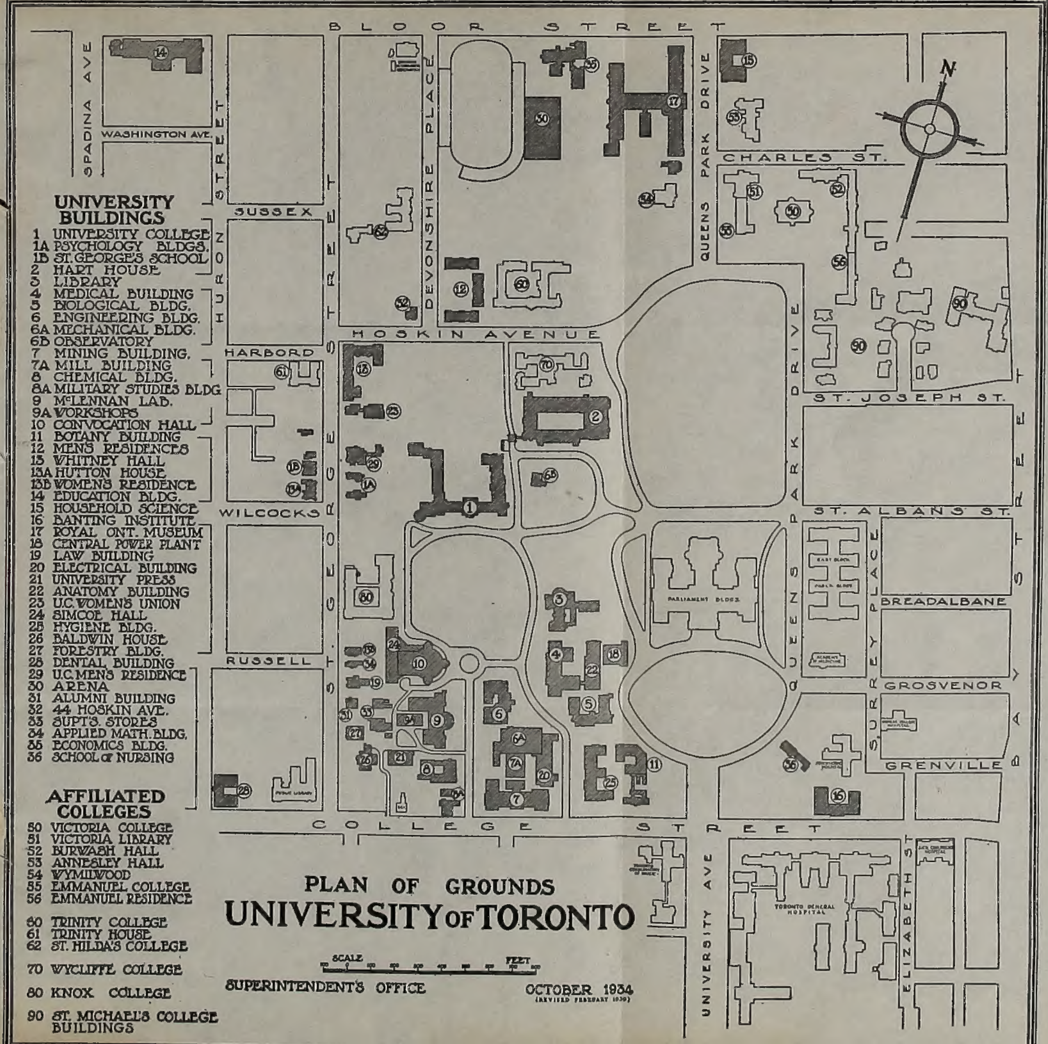
BLOOR STREET
SPADINA AVE
WASHINGTON AVE.
HURON STREET
SUSSEX
HARBORD
WILCOCKS
RUSSELL
ST. GEORGE STREET
DEVONSHIRE PLACE
HOSKIN AVENUE
QUEENS PARK DRIVE
CHARLES ST.
ST. JOSEPH ST.
ST. ALBANS ST.
BREADALBANE
GROSVENOR
GRENVILLE
SURREY PLACE
BAY STREET
COLLEGE STREET
UNIVERSITY AVE
ELIZABETH ST
N
PARLIAMENT BLDGS.
EAST BLOCK
TORONTO GENERAL HOSPITAL
UNIVERSITY BUILDINGS
1 UNIVERSITY COLLEGE
1A PSYCHOLOGY BLDGS.
1B ST. GEORGE'S SCHOOL
2 HART HOUSE
3 LIBRARY
4 MEDICAL BUILDING
5 BIOLOGICAL BLDG.
6 ENGINEERING BLDG.
6A MECHANICAL BLDG.
6B OBSERVATORY
7 MINING BUILDING.
7A MILL BUILDING
8 CHEMICAL BLDG.
8A MILITARY STUDIES BLDG
9 McLENNAN LAB.
9A WORKSHOPS
10 CONVOCATION HALL
11 BOTANY BUILDING
12 MEN'S RESIDENCES
13 WHITNEY HALL
13A HUTTON HOUSE
13B WOMENS RESIDENCE
14 EDUCATION BLDG.
15 HOUSEHOLD SCIENCE
16 BANTING INSTITUTE
17 ROYAL ONT. MUSEUM
18 CENTRAL POWER PLANT
19 LAW BUILDING
20 ELECTRICAL BUILDING
21 UNIVERSITY PRESS
22 ANATOMY BUILDING
23 U.C. WOMEN'S UNION
24 SIMCOE HALL
25 HYGIENE BLDG.
26 BALDWIN HOUSE
27 FORESTRY BLDG.
28 DENTAL BUILDING
29 U.C. MEN'S RESIDENCE
30 ARENA
31 ALUMNI BUILDING
32 44 HOSKIN AVE.
33 SUPT'S. STORES
34 APPLIED MATH. BLDG.
35 ECONOMICS BLDG.
36 SCHOOL OF NURSING
AFFILIATED COLLEGES
50 VICTORIA COLLEGE
51 VICTORIA LIBRARY
52 BURWASH HALL
53 ANNESLEY HALL
54 WYMILWOOD
55 EMMANUEL COLLEGE
56 EMMANUEL RESIDENCE
60 TRINITY COLLEGE
61 TRINITY HOUSE
62 ST. HILDA'S COLLEGE
70 WYCLIFFE COLLEGE
80 KNOX COLLEGE
90 ST. MICHAEL'S COLLEGE BUILDINGS
PLAN OF GROUNDS
UNIVERSITY OF TORONTO
SCALE
FEET
SUPERINTENDENT'S OFFICE
OCTOBER 1934

UNIVERSITY OF TORONTO

CALENDAR

FACULTY OF APPLIED SCIENCE AND ENGINEERING

1945-1946

THE UNIVERSITY OF TORONTO PRESS
1945

CONTENTS

			Page
SECTION	I.	Calendar	5
"	II.	Administrative Officers	7
"	III.	Teaching Staff	8
"	IV.	Historical Sketch	16
"	V.	Admission and Registration	17
"	VI.	Fees, Deposits and Expenses	21
"	VII.	Courses and Degrees	23
"	VIII.	School of Engineering Research	25
"	IX.	Curriculum	26
"	X.	Examinations	147
"	XI.	Scholarships	199
"	XII.	Libraries and Laboratories	164
"	XIII.	Discipline	178
"	XIV.	University Health Service and Physical Training	180
"	XV.	Hart House	183
"	XVI.	Student Organizations	185
"	XVII.	Lodging and Board	192
"	XVIII.	Engineering Alumni Association	194
		Appendix I—Graduate Studies	196
		Appendix II—Post-Discharge Re-Establishment	201
		Index	205

1945 CALENDAR 1945

JANUARY

Sun.	..	7	14	21	28
Mon.	1	8	15	22	29
Tues.	2	9	16	23	30
Wed.	3	10	17	24	31
Thur.	4	11	18	25	....
Fri.	5	12	19	26	....
Sat.	6	13	20	27	....

FEBRUARY

Sun.	..	4	11	18	25
Mon.	..	5	12	19	26
Tues.	..	6	13	20	27
Wed.	..	7	14	21	28
Thur.	1	8	15	22	....
Fri.	2	9	16	23	....
Sat.	3	10	17	24	....

MARCH

Sun.	..	4	11	18	25
Mon.	..	5	12	19	26
Tues.	..	6	13	20	27
Wed.	..	7	14	21	28
Thur.	1	8	15	22	29
Fri.	2	9	16	23	30
Sat.	3	10	17	24	31

APRIL

Sun.	1	8	15	22	29
Mon.	2	9	16	23	30
Tues.	3	10	17	24	....
Wed.	4	11	18	25	....
Thur.	5	12	19	26	....
Fri.	6	13	20	27	....
Sat.	7	14	21	28	....

MAY

Sun.	..	6	13	20	27
Mon.	..	7	14	21	28
Tues.	1	8	15	22	29
Wed.	2	9	16	23	30
Thur.	3	10	17	24	31
Fri.	4	11	18	25	....
Sat.	5	12	19	26	....

JUNE

Sun.	..	3	10	17	24
Mon.	..	4	11	18	25
Tues.	..	5	12	19	26
Wed.	..	6	13	20	27
Thur.	..	7	14	21	28
Fri.	1	8	15	22	29
Sat.	2	9	16	23	30

JULY

Sun.	1	8	15	22	29
Mon.	2	9	16	23	30
Tues.	3	10	17	24	31
Wed.	4	11	18	25	....
Thur.	5	12	19	26	....
Fri.	6	13	20	27	....
Sat.	7	14	21	28	....

AUGUST

Sun.	..	5	12	19	26
Mon.	..	6	13	20	27
Tues.	..	7	14	21	28
Wed.	1	8	15	22	29
Thur.	2	9	16	23	30
Fri.	3	10	17	24	31
Sat.	4	11	18	25	....

SEPTEMBER

Sun.		2	9	16	23	30
Mon.		3	10	17	24	....
Tues.		4	11	18	25	....
Wed.		5	12	19	26	....
Thur.		6	13	20	27	....
Fri.		7	14	21	28	....
Sat.	1	8	15	22	29	....

OCTOBER

Sun.	..	7	14	21	28
Mon.	1	8	15	22	29
Tues.	2	9	16	23	30
Wed.	3	10	17	24	31
Thur.	4	11	18	25	....
Fri.	5	12	19	26	....
Sat.	6	13	20	27	....

NOVEMBER

Sun.	..	4	11	18	25
Mon.	..	5	12	19	26
Tues.	..	6	13	20	27
Wed.	..	7	14	21	28
Thur.	1	8	15	22	29
Fri.	2	9	16	23	30
Sat.	3	10	17	24	....

DECEMBER

Sun.		2	9	16	23	30
Mon.		3	10	17	24	31
Tues.		4	11	18	25	....
Wed.		5	12	19	26	....
Thur.		6	13	20	27	....
Fri.		7	14	21	28	....
Sat.	1	8	15	22	29	....

1946 CALENDAR 1946

JANUARY

Sun.	..	6	13	20	27
Mon.	..	7	14	21	28
Tues.	1	8	15	22	29
Wed.	2	9	16	23	30
Thur.	3	10	17	24	31
Fri.	4	11	18	25	....
Sat.	5	12	19	26	....

FEBRUARY

Sun.	..	3	10	17	24
Mon.	..	4	11	18	25
Tues.	..	5	12	19	26
Wed.	..	6	13	20	27
Thur.	..	7	14	21	28
Fri.	1	8	15	22	....
Sat.	2	9	16	23	....

MARCH

Sun.		3	10	17	24	31
Mon.		4	11	18	25	....
Tues.		5	12	19	26	....
Wed.		6	13	20	27	....
Thur.		7	14	21	28	....
Fri.	1	8	15	22	29	....
Sat.	2	9	16	23	30	....

APRIL

Sun.	..	7	14	21	28
Mon.	1	8	15	22	29
Tues.	2	9	16	23	30
Wed.	3	10	17	24	....
Thur.	4	11	18	25	....
Fri.	5	12	19	26	....
Sat.	6	13	20	27	....

MAY

Sun.	..	5	12	19	26
Mon.	..	6	13	20	27
Tues.	..	7	14	21	28
Wed.	1	8	15	22	29
Thur.	2	9	16	23	30
Fri.	3	10	17	24	31
Sat.	4	11	18	25	....

JUNE

Sun.		2	9	16	23	30
Mon.		3	10	17	24	....
Tues.		4	11	18	25	....
Wed.		5	12	19	26	....
Thur.		6	13	20	27	....
Fri.		7	14	21	28	....
Sat.	1	8	15	22	29	....

JULY

Sun.	..	7	14	21	28
Mon.	1	8	15	22	29
Tues.	2	9	16	23	30
Wed.	3	10	17	24	31
Thur.	4	11	18	25	....
Fri.	5	12	19	26	....
Sat.	6	13	20	27	....

AUGUST

Sun.	..	4	11	18	25
Mon.	..	5	12	19	26
Tues.	..	6	13	20	27
Wed.	..	7	14	21	28
Thur.	1	8	15	22	29
Fri.	2	9	16	23	30
Sat.	3	10	17	24	31

SEPTEMBER

Sun.	1	8	15	22	29
Mon.	2	9	16	23	30
Tues.	3	10	17	24	....
Wed.	4	11	18	25	....
Thur.	5	12	19	26	....
Fri.	6	13	20	27	....
Sat.	7	14	21	28	....

OCTOBER

Sun.	..	6	13	20	27
Mon.	..	7	14	21	28
Tues.	1	8	15	22	29
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Thur.	3	10	17	24	31
Fri.	4	11	18	25	....
Sat.	5	12	19	26	....

NOVEMBER

Sun.	..	3	10	17	24
Mon.	..	4	11	18	25
Tues.	..	5	12	19	26
Wed.	..	6	13	20	27
Thur.	..	7	14	21	28
Fri.	1	8	15	22	29
Sat.	2	9	16	23	30

DECEMBER

Sun.	1	8	15	22	29
Mon.	2	9	16	23	30
Tues.	3	10	17	24	31
Wed.	4	11	18	25	....
Thur.	5	12	19	26	....
Fri.	6	13	20	27	....
Sat.	7	14	21	28	....

SECTION I. CALENDAR 1945-1946

FALL TERM 1945

July 16 Mon....Last day for receiving applications for Supplemental Examinations.

Aug. 11 Sat.....Students of the III Year, Courses 1, 2, and 9, report at University Survey Camp.

Sept. 1 Sat.....Last day for receiving applications for admission to the I Year.

Sept. 3 Mon....Labour Day. Buildings closed.

Sept. 4 Tues....Students of the II Year, Course 6, report at Mining Building for Chemical Laboratory.

Sept. 10 Mon....Supplemental Examinations commence.

Sept. 20 Thur....Special meeting of Faculty Council.

Sept. 24 Mon....Registration in person of the I Year from 9.30 a.m. to 11.30 a.m., and 1.45 p.m. to 4.30 p.m., Mining Building.

Last day for receiving I Year fees.

Students in Architecture of the II, III, and IV Years report at University Survey Camp.

Sept. 25 Tues....Registration in person of the II, III, and IV Years (except Architecture) and V Year Architecture from 9.30 a.m. to 11.30 a.m., and 1.45 p.m. to 4.30 p.m., Mining Building.

Last day for receiving fees.

The Dean's address to I Year at 8.30 a.m. in Room 38, Engineering Building.

Preliminary instruction for the I Year in Room 38, Engineering Building.

Meeting of Faculty Council.

Sept. 26 Wed....Lectures and Laboratory work commence at 8.30 a.m.

The opening address by the President to the students of all faculties at 3.45 p.m. in Convocation Hall.

Oct. 1 Mon....Meeting of Faculty Council.

Oct. 3 Wed....Registration in person, at the Faculty Office, of II, III, and IV Years in Architecture, from 9.30 a.m. to 12 noon.

Oct. 6 Sat.....Meeting of Caput.

Oct. 12 Fri.....Meeting of Senate.

Oct. 15 Mon....Meeting of Engineering Society.

Nov. 1 Thur....Meeting of Faculty Council.

Nov. 9 Fri......Meeting of Senate.

Nov. 12 Mon....Remembrance Day Service at the Soldiers' Tower at 11.00 a.m. Neither lectures nor laboratory classes given from 9.30 a.m. to 1.00 p.m.

Nov. 13 Tues....Meeting of Engineering Society.
Dec. 3 Mon....Meeting of Faculty Council.
Dec. 6 Thur....Meeting of Engineering Society.
Dec. 14 Fri.....Meeting of Senate.
Dec. 20 Thur....Term ends at 4.30 p.m.

SPRING TERM 1946

Jan. 1 Tues....Buildings closed.
Jan. 3 Thur....Spring Term begins.
Mid-session Examinations commence.
Jan. 10 Thur....Meeting of Faculty Council.
Meeting of Engineering Society.
Jan. 11 Fri.....Meeting of Senate.
Jan. 15 Tues....Last day for receiving the second term instalment of fees.
Feb. 1 Fri.....Meeting of Faculty Council.
Feb. 8 Fri.....Meeting of Senate.
Feb. 11 Mon....Meeting of Engineering Society.
Feb. 26 Tues....Meeting of Engineering Society (nominations).
Mar. 1 Fri.....Meeting of Faculty Council.
Engineering Society Annual Elections.
Mar. 8 Fri.....Meeting of Senate.
Mar. 13 Wed....Engineering Society Annual General Meeting.
Apr. 1 Mon....Meeting of Faculty Council.
Apr. 6 Sat.....Term ends.
Apr. 10 Wed....Annual Examinations commence.
Apr. 12 Fri.....Meeting of Senate.
Apr. 19 Fri.....Good Friday.
May 1 Wed....Meeting of Faculty Council.
May 10 Fri.....Meeting of Senate.
June 5 Wed....Meeting of Senate.
June 6-7 Thur.-Fri..University Commencement.

SECTION II. ADMINISTRATIVE OFFICERS

THE UNIVERSITY

President.............SIDNEY SMITH, K.C., M.A., LL.B., LL.D., D.C.L.
Registrar...............................A. B. FENNELL, M.C., M.A.
Bursar....................................C. E. HIGGINBOTTOM
Librarian..........................W. S. WALLACE, M.A., F.R.S.C.
Superintendent of Buildings and Grounds..........A. D. LEPAN, B.A.Sc.
Director of University Extension and Publicity........W. J. DUNLOP, B.A., B. PAED., LL.D.
Warden of Hart House..................J. B. BICKERSTETH, M.C., M.A.
Director of University Health Service....R. W. I. URQUHART, M.A., M.D.
Assistant Director of University Health Service in Charge of Women MISS G. E. MULOCK, M.B.
Manager of the University of Toronto Press..........*A. G. BURNS, B.A.

THE FACULTY OF APPLIED SCIENCE AND ENGINEERING

Dean...C. R. YOUNG, B.A.Sc., C.E., D.Eng., M.E.I.C., M.AM. SOC. C.E.
Assistant Dean and Secretary.....W. S. WILSON, E.D., B.A.Sc., M.E.I.C.
Assistant Secretary..................................MISS E. BIRKETT

INQUIRIES

Inquiries about admission to the Faculty of Applied Science and Engineering should be sent to the Registrar of the University.

Communications relating to curriculum, instruction, and examinations, in the Faculty of Applied Science and Engineering should be sent to the Secretary of the Faculty.

**On leave of absence for the duration of the war.*

SECTION III. TEACHING STAFF

1944-1945

PROFESSORES EMERITI

G. R. ANDERSON, M.A., A.M. (Harv.) — 5 duMaurier Blvd.
Professor Emeritus of Engineering Physics and Photography

R. W. ANGUS, B.A.Sc., M.E., HON. M.E.I.C., Hon. Mem. A.S.M.E.
Professor Emeritus of Mechanical Engineering. — Mechanical Bldg.

G. A. GUESS, M.A. (Qu.) — Oakville
Professor Emeritus of Metallurgical Engineering

H. E. T. HAULTAIN, C.E. — National Club
Professor Emeritus of Mining Engineering

DEPARTMENT OF APPLIED PHYSICS

K. B. JACKSON, B.A.Sc., M.I.E.S. — 362 Glengrove Ave. W.
Associate Professor of Applied Physics.

V. L. HENDERSON, B.A.Sc., A.M. (Mich.), Mem. Acoustical Soc.
Assistant Professor of Applied Physics. — 397 Glengrove Ave. W.

E. L. DODINGTON, B.A.Sc. — 415 Sutherland Dr.
Lecturer in Applied Physics

H. C. JONES, B.Sc. (E.E.) (Man.) — 66 Harshaw Ave.
Demonstrator in Applied Physics (part time).

H. W. ALLAN, M.A.Sc. — 579 Sherbourne St.
Demonstrator in Applied Physics.

T. E. MUNFORD, B.A.Sc. — North H., U. of T.
Demonstrator in Applied Physics

SCHOOL OF ARCHITECTURE

H. H. MADILL, V.D., B.A.Sc., F.R.A.I.C. — 14 Strathallan Blvd.
Professor of Architecture.

E. R. ARTHUR, M.A., B.ARCH. (Liv.), A.R.I.B.A. — 20 Montclair Ave.
Professor of Architectural Design.

H. J. BURDEN, D.S.O., D.F.C., B.A.Sc., M.F.A. (Princ.)
Assistant Professor of Architecture.
(On leave of absence for war service.)

W. E. CARSWELL, B.ARCH., M.R.A.I.C. — 462 St. Clement's Ave.
Assistant Professor of Architectural Drawing.

J. A. MURRAY, B.ARCH. — 220 Carlton St.
Special Instructor in Architectural Design (part time)

F. COATES, A.R.C.A. — Scarborough Bluffs
Instructor in Modelling (part time).

H. B. DUNINGTON-GRUBB, B.S.A. (Cornell) — 4 St. Thomas St.
Special Lecturer in Landscape Architecture (part time).

A. P. C. ADAMSON, B.A. (Camb.) — 185 Poplar Plains Rd.
Special Lecturer in Architecture (part time).

DEPARTMENT OF CHEMICAL ENGINEERING AND APPLIED CHEMISTRY

J. W. BAIN, B.A.Sc., F.R.S.C., F.R.I.C. — 393 Brunswick Ave.
Professor of Chemical Engineering.

M. C. BOSWELL, B.A.Sc., A.M. (Harv.), PH.D., F.R.S.C. — Mining Building
Professor of Organic Chemistry, in Chemical Engineering.

E. A. SMITH, M.A. (McM.), M.E.I.C. — Mining Building
Professor of Industrial Chemistry.

R. R. McLAUGHLIN, M.A.Sc., M.A., PH.D., M.E.I.C. — 52 Rosedale Rd.
Professor of Chemical Engineering.

J. G. BRECKENRIDGE, B.A.Sc., PH.D. (Camb.) — 23 Douglas Cresc.
Assistant Professor of Chemical Engineering.

W. C. MACDONALD, M.A.Sc., A.M.I.CHEM.E. — 158 St. Clair Ave. E.
Assistant Professor of Chemical Engineering.

A. M. FITZGERALD, B.A.Sc. — Mining Building
Lecturer in Chemical Engineering.

L. J. RUBIN, M.A.Sc. — 546 Palmerston Blvd.
Instructor in Chemical Engineering.

M. ADELMAN, M.A.Sc. — Apt. 3, 324½ Bloor St. W.
Instructor in Chemical Engineering.

W. G. MACELHINNEY, B.A.Sc. — Orchard Ave., Port Credit
Instructor in Chemical Engineering.

W. F. GRAYDON, B.A.Sc. — 22 Glendonwynne Rd.
Instructor in Chemical Engineering.

MRS. H. HAMPSON, B.Sc. (Manch.) — Mining Building
Demonstrator in Chemical Engineering.

G. L. MILLIGAN, B.A.Sc. — 72 Madison Ave.
Demonstrator in Chemical Engineering.

C. M. HUMBER, B.A.Sc., M.A. (Col.), B.TH. (McM.) — 107 Burgess Ave.
Demonstrator in Chemical Engineering.

C. E. DROVER, B.Sc. (Dal.) — 309 Brunswick Ave.
Demonstrator in Chemical Engineering.

F. A. DEMARCO, M.A.Sc. — St. Michael's College
Demonstrator in Chemical Engineering.

C. GOWDEY, B.A. — 187 Langley Ave.
Demonstrator in Chemical Engineering.

H. I. HADLER, B.A.Sc. — 592 Palmerston Ave.
Demonstrator in Chemical Engineering.

F. KUBATH, B.A.Sc. 36 Earl St.
Demonstrator in Chemical Engineering.

W. A. MORSE, B.A.Sc. Victoria College
Demonstrator in Chemical Engineering.

F. J. QUAIL, B.A.Sc. 26 Glenwood Ave.
Demonstrator in Chemical Engineering.

E. YURASYK, B.A.Sc. 171-5th St., New Toronto
Demonstrator in Chemical Engineering.

T. L. CROSSLEY Nitro, P.Q.
Special Lecturer in Pulp and Paper.

A. V. DELAPORTE, CHEM. E. 5 Millerson Ave.
Special Lecturer in Sanitary Chemistry.

DEPARTMENT OF CIVIL ENGINEERING: MUNICIPAL AND STRUCTURAL

T. R. LOUDON, V.D., B.A.Sc., M.E.I.C. 189 Sheldrake Blvd.
Professor of Civil Engineering and Aeronautics: Municipal and Structural

C. F. MORRISON, B.E. (Sask.), M.Sc. (McG.), M.E.I.C. 21 Douglas Cresc.
Associate Professor of Civil Engineering: Municipal and Structural.

W. L. SAGAR, B.A.Sc., C.E., M.E.I.C.
Associate Professor of Civil Engineering: Municipal and Structural.
(On leave of absence for war service.)

R. F. LEGGET, M.ENG. (Liv.), M. INST. C.E., M.E.I.C. 46 Castle Frank Cresc.
Associate Professor of Civil Engineering: Municipal and Structural.

M. W. HUGGINS, M.A.Sc., M.E.I.C. 531 Windermere Ave.
Assistant Professor of Civil Engineering: Municipal and Structural.

C. E. HELWIG, M.A.Sc., M.E.I.C. 452 Castlefield Ave.
Lecturer in Civil Engineering: Municipal and Structural.

B. ETKIN, B.A.Sc. 317 Lauder Ave.
Lecturer in Civil Engineering: Municipal and Structural.

A. E. BERRY, M.A.Sc., C.E., PH.D., M.E.I.C. 235 Gainsborough Rd.
Special Lecturer in Municipal Engineering.

W. H. M. LAUGHLIN, M.A.Sc., C.E., M.E.I.C. 16 Neepawa Ave.
Special Lecturer in Civil Engineering: Municipal and Structural.

C. W. DILLANE, B.A.Sc. 1193 Avenue Rd.
Demonstrator in Civil Engineering: Municipal and Structural.

J. O. GORMAN, M.A.Sc. 146 Vaughan Rd.
Demonstrator in Civil Engineering: Municipal and Structural ((part time).

R. G. WYKES, B.A.Sc. 5 Webb Ave.
Demonstrator in Civil Engineering: Municipal and Structural (part time).

DEPARTMENT OF CIVIL ENGINEERING: SURVEYING AND GEODESY

W. M. TREADGOLD, B.A., M.E.I.C. 13 Woodlawn Ave. E.
Professor of Civil Engineering: Surveying and Geodesy.
S. R. CRERAR, B.A.Sc., D.L.S. 22 Kingsmill Rd.
Professor of Civil Engineering: Surveying and Geodesy.
E. W. BANTING, B.A.Sc. 101 Farnham Ave.
Associate Professor of Civil Engineering: Surveying and Geodesy.
J. W. MELSON, B.A.Sc. 69 Walmsley Blvd.
Associate Professor of Civil Engineering: Surveying and Geodesy.
T. L. ROWE 104 Braemore Gdns.
Lecturer in Civil Engineering: Surveying and Geodesy.
S. H. DEJONG, M.Sc. (Man.) 57 Duggan Ave.
Lecturer in Civil Engineering: Surveying and Geodesy.
A. F. FASSELL 14 Windsor Ave.
Demonstrator in Civil Engineering: Surveying and Geodesy (first term).

DEPARTMENT OF ELECTRICAL ENGINEERING

H. W. PRICE, E.E., Mem. A.I.E.E. 40 Ava Rd.
Professor of Electrical Engineering.
A. R. ZIMMER, B.A.Sc., Mem. A.I.E.E. 282 Riverside Dr.
Professor of Electrical Engineering.
V. G. SMITH, B.A.Sc., Mem. A.I.E.E. 142 Dawlish Ave.
Associate Professor of Electrical Engineering.
B. DEF. BAYLY, B.A.Sc.
Associate Professor of Electrical Engineering.
(On leave of absence for war service.)
D. N. CASS-BEGGS, B.Sc.Tech., (Manc.), A.M.I.E.E.
Assistant Professor of Electrical Engineering. 78 Chestnut Park Rd.
J. E. REID, B.A.Sc., Mem. A.I.E.E. 152 Donegal Dr.
Assistant Professor of Electrical Engineering.
L. S. LAUCHLAND, M.A.Sc., Assoc. A.I.E.E.
Lecturer in Electrical Engineering.
(On leave of absence for war service.)
R. G. ANTHES, B.A.Sc., Assoc. I.R.E. 506 Donlands Ave.
Lecturer in Electrical Engineering.
R. J. BROWN, B.A.Sc., Mem. A.I.E.E. 272 Beresford Ave.
Special Lecturer in Electrical Engineering.
E. F. BUCKLEY, B.A.Sc. 150 Bedford Rd.
Demonstrator in Electrical Engineering.
H. A. COURTICE, B.A.Sc. 3317 Danforth Ave.
Demonstrator in Electrical Engineering.
V. B. COXWORTH, B.A.Sc. 80 Little Blvd.
Demonstrator in Electrical Engineering.

R. C. HENDERSON, B.A.Sc. — 108 Ashburnham Rd.
Demonstrator in Electrical Engineering.

W. E. HODGES, B.A.Sc. — Apt. 17, 27 Christie St.
Demonstrator in Electrical Engineering.

W. L. PHOENIX, B.A.Sc. — 147 Hanson Ave.
Demonstrator in Electrical Engineering.

P. A. RICKARD, B.A.Sc. — 128 Park Rd.
Demonstrator in Electrical Engineering.

R. SCOTT, B.A.Sc. — 471 St. Clements Ave.
Demonstrator in Electrical Engineering.

A. SMITH, B.A. — 52 Parkway Ave.
Demonstrator in Electrical Engineering

DEPARTMENT OF ENGINEERING DRAWING

J. R. COCKBURN, M.C., V.D., B.A.Sc., M.E.I.C. — 100 Walmer Rd.
Professor of Descriptive Geometry.

W. J. T. WRIGHT, M.B.E., B.A.Sc., B.A., M.E.I.C. — 126 Melrose Ave.
Professor of Engineering Drawing.

W. B. DUNBAR, B.A.Sc., M.E.I.C. — 241 Glebeholme Blvd.
Associate Professor of Engineering Drawing.

A. WARDELL, B.A.Sc. — 124 Melrose Ave.
Associate Professor of Engineering Drawing.

P. V. JERMYN, B.A.Sc. — 109 Cluny Dr.
Assistant Professor of Engineering Drawing.

J. J. SPENCE, M.E.I.C. — Apt. 216, 3 du Maurier Blvd.
Lecturer in Engineering Drawing.

G. R. EDWARDS, B.A.Sc. — 28 Balmoral Ave.
Lecturer in Engineering Drawing.

D. P. SCOTT, M.A.Sc. — 471 St. Clements Ave.
Instructor in Engineering Drawing.

W. S. GLYNN, B.A.Sc. — 126 St. Helens Ave.
Demonstrator in Engineering Drawing.

F. E. DELOUME, B.A. (U.B.C.) — 11 Willcocks St.
Demonstrator in Engineering Drawing.

E. MYATT, B.A.Sc. — 88 Warden Ave.
Demonstrator in Engineering Drawing.

H. J. FRANKLIN, B.A.Sc. — 288 St. Clarens Ave.
Demonstrator in Engineering Drawing (part time).

F. J. SIMPSON, B.Sc. (Sask.) — 1531 Bathurst St.
Demonstrator in Engineering Drawing (part time).

J. W. SPEIGHT, M.A. (West.) — 132 Royal York Rd. N.
Demonstrator in Engineering Drawing (part time).

DEPARTMENT OF MECHANICAL ENGINEERING

E. A. ALLCUT, M.Sc. (Birm.), M.E., F.R.Aë.S., M.I.Mech.E.
Professor of Mechanical Engineering. 48 Foxbar Rd.
W. G. McINTOSH, B.A.Sc., Mem. A.S.M.E. 114A Madison Ave.
Associate Professor of Mechanical Engineering.
G. R. LORD, B.A.Sc., S.M. (Mass. Inst. Tech.), Ph.D., M.E.I.C.
Associate Professor of Mechanical Engineering. 239 Dawlish Ave.
R. C. WIREN, B.A.Sc., Mem. A.S.M.E., M.E.I.C. 211 College St.
Associate Professor of Mechanical Engineering.
D. D. PANABAKER, B.A.Sc., Jun. A.S.M.E. 33 Sutherland Dr.
Assistant Professor of Mechanical Engineering.
I. W. SMITH, B.A.Sc., Jun. A.S.M.E. 40 Hazelton Ave.
Assistant Professor of Mechanical Engineering.
L. E. JONES, B.Sc. (C.E.) (Man.), M.A.Sc., PH.D. 140 Divadale Dr.
Assistant Professor of Mechanical Engineering
W. A. WALLACE, B.A.Sc. 74 Glendale Ave.
Lecturer in Mechanical Engineering.
R. T. WAINES, B.A.Sc. 43 Albertus Ave.
Lecturer in Mechanical Engineering.
D. J. PARRISH, B.A.Sc. 790 Eglinton Ave. W.
Lecturer in Mechanical Engineering.
W. BRUCE, B.A.Sc., Jun. A.S.M.E. 16 Graham Gdns.
Instructor in Mechanical Engineering.
D. G. HUBER, B.A.Sc. 95 Walmer Rd.
Instructor in Mechanical Engineering.
O. CLODMAN, B.A.Sc. 55 Beatrice St.
Demonstrator in Mechanical Engineering
G. G. GILCHRIST, B.A.Sc. 61 Braemore Gdns.
Demonstrator in Mechanical Engineering.
B. H. LLOYD, B.A.Sc. North H., U. of T.
Demonstrator in Mechanical Engineering.
W. E. RIGG, B.A.Sc. 124 Bedford Rd.
Demonstrator in Mechanical Engineering.
B. D. WOOD, B.A.Sc. 2006 Bathurst St.
Demonstrator in Mechanical Engineering.

DEPARTMENT OF METALLURGICAL ENGINEERING

L. M. PIDGEON, B.Sc. (Ox.), Ph.D. (McG.), F.R.S.C.
Professor of Metallurgical Engineering 185 Rosedale Heights Dr.
J. A. NEWCOMBE, B.Sc. (Lond.), A.R.S.M., F.R.I.C. 82 Moore Ave.
Professor of Metallurgical Engineering.
R. J. MONTGOMERY, B.Sc., Cer.E. (Ohio) 2 Glenview Ave.
Associate Professor of Ceramics.
J. E. TOOMER, B.Sc. (North Carolina) 707 Eglinton Ave. W.
Assistant Professor of Metallurgical Engineering.

F. M. AIMONE, B.A.Sc. 15 Prince Arthur Ave.
Demonstrator in Metallurgical Engineering.

DEPARTMENT OF MINING ENGINEERING

C. G. WILLIAMS, B.A.Sc. 417 Rosemary Rd.
Professor of Mining Engineering.
J. T. KING, B.A.Sc. 126 Manor Rd. E.
Professor of Assaying.
S. E. WOLFE, M.A.Sc. Streetsville
Assistant Professor of Mining Engineering.
S. G. FARRAR, B.A.Sc. Lorne Park
Instructor in Mining Engineering.
L. PANCER, B.A.Sc. 154 Gorevale Ave
Instructor in Mining Engineering.
G. K. CLEMENT, B.A.Sc. 53 Harbord St.
Demonstrator in Mining Engineering.

OTHER SPECIAL LECTURERS

R. R. GRANT, O.L.S., C.A. 58 Poplar Plains Rd.
Special Lecturer in Accountancy and Business.
P. H. MILLS, B.A.Sc. 80 King St. W.
Special Lecturer in Engineering Law.

PROFESSORS OF OTHER FACULTIES GIVING INSTRUCTION TO STUDENTS IN APPLIED SCIENCE

D. S. AINSLIE, M.A., PH.D. 88 Chatsworth Dr.
Associate Professor of Physics.
MISS E. J. ALLIN, M.A., Ph.D. Apt. 35, 8 St. Thomas St.
Assistant Professor of Physics.
F. C. AULD, K.C., B.A. (McG.), M.A., B.C.L. (Ox.)
Professor of Jurisprudence. 21 Poplar Plains Cresc.
C. BARNES, M.Sc. (Leeds), PH.D. 269 St. Leonards Ave.
Associate Professor of Physics.
F. E. BEAMISH, M.A. (McM.) 7 Relmar Rd.
Associate Professor of Chemistry.
S. BEATTY, M.A., Ph.D., F.R.S.C. 537 Markham St.
Professor of Mathematics.
V. W. BLADEN, M.A. (Ox.), F.R.S.C. 103 Woodlawn Ave. W.
Professor of Political Economy.
A. A. BRANT, M.A., PH.D. (Berlin) 15 Grenadier Heights
Assistant Professor of Geophysics.
R. BRAUER, PH.D. (Berlin) 75 Oriole Pkwy.
Associate Professor of Mathematics.
J. D. BURK, B.A. 30 Duggan Ave.
Associate Professor of Mathematics.

J. T. BURT-GERRANS, Phm.B., M.A., Ph.D. 46 Dewson St.
Professor of Electrochemistry.

E. F. BURTON, O.B.E., B.A. (Tor.), (Camb.), Ph.D., F.R.S.C.
Professor of Physics. 224 Queen's Drive, Weston

M. F. CRAWFORD, B.A. (West.), M.A., Ph.D., F.R.S.C.
Associate Professor of Physics. 11 Washington Ave.

D. B. DE LURY, M.A., Ph.D. 88 Bowie Ave.
Assistant Professor of Mathematics.

J. B. FERGUSON, B.A., F.R.S.C. 100 Albertus Ave.
Associate Professor of Chemistry.

L. GILCHRIST, M.A., PH.D. (Chic.), F.R.S.C. 8 Deer Park Cresc.
Professor of Physics.

T. HEDMAN, Ph.B. (Chic.) 171 Old Forest Hill Rd.
Associate Professor of German.

H. J. C. IRETON, M.A., Ph.D. 76 Lonsdale Rd.
Professor of Physics.

N. B. KEEVIL, M.Sc. (Sask.), PH.D. (Harv.) Lake Shore Rd.
Assistant Professor of Geophysics. Port Credit

MISS C. C. KRIEGER, M.A., Ph.D. 382 Roxton Rd.
Assistant Professor of Mathematics.

A. MCLEAN, B.A. 488 Spadina Ave.
Professor of Geology.

V. B. MEEN, M.A., PH.D., 34 Birchview Blvd.
Assistant Professor of Mineralogy.

E. S. MOORE, M.A., Ph.D. (Chic.), F.R.S.C. 18 Indian Grove
Professor of Geology.

M. A. PEACOCK, M.A. (Harv.), Ph.D., D.Sc. (Glas.), F.R.S.C.
Professor of Minerology. 81 Moore Ave.

I. R. POUNDER, M.A., Ph.D. (Chic.) 19 Glen Gordon Rd.
Professor of Mathematics.

R. RICHMOND, M.A., PH.D. 41 Roslin Ave.
Assistant Professor of Physics.

D. A. F. ROBINSON, M.A., Ph.D. (Chic.) 592 University Ave.
Associate Professor of Mathematics.

L. J. ROGERS, B.A.Sc., M.A. 110 Garfield Ave.
Professor of Analytical Chemistry.

J. SATTERLY, M.A. (Camb.), D.Sc. (London.), F.R.S.C. 95 Bernard Ave.
Professor of Physics.

A. F. C. STEVENSON, M.A., Ph.D. (Camb.), F.R.S.C. 28 Summerhill Gdns.
Associate Professor of Applied Mathematics.

W. J. WEBBER, B.A. (Camb.) 18 Kappele Ave.
Associate Professor of Mathematics.

A. WEINSTEIN, Ph.D. (Zurich), D.És.Sc. (Paris) 469 Spadina Rd.
Assistant Professor of Applied Mathematics.

F. E. W. Wetmore, B.Sc. (N.B.), M.A., Ph.D. 53 Bayview Ave.
Assistant Professor of Chemistry.

A. M. WYNNE, M.A. (Qu.), PH.D., F.R.S.C. 27 Lytton Blvd.
Professor of Biochemistry.

SECTION IV. HISTORICAL SKETCH

The Legislative Assembly of the Province of Ontario during the Session of 1877 gave its sanction to the establishment of a School of Practical Science on the basis proposed in the memorandum of the Minister of Education confirmed by the Lieutenant-Governor in Council on the 3rd day of February, 1877.

By the scheme thus approved the Government effected an arrangement with the Council of University College whereby the instruction given by its professors and lecturers in all departments of science embraced in the work of the School was made available to students of the School. This arrangement was brought to an end in 1889 by the transfer of the departments of science, above referred to, from University College to the University of Toronto under the operation of the University Federation Act. In order that the students of the School might continue to enjoy the advantage of the instruction of the above departments, the Senate of the University of Toronto passed a statute in October, 1889, affiliating the School with the University. The statute was confirmed by the Lieutenant-Governor on the 30th day of October, 1889.

By an Order-in-Council, approved by the Lieutenant-Governor on the 6th day of November, 1889, a Principal was appointed, and the management of the School was entrusted to a council composed of the Principal as chairman, and the Professors, Lecturers, and Demonstrators appointed in the Teaching Faculty of the School.

On December 14th, 1900, the Senate, by statute subsequently approved by the Lieutenant-Governor in Council, established a Faculty of Applied Science and Engineering but without assuming any liability for its support or maintenance. Under this statute the teaching staff and examiners of the School of Practical Science became the teaching staff and examiners of the Faculty, although the University retained the right to appoint the examiners for the Bachelor of Applied Science and professional degrees. By the University Act of 1906 the School of Practical Science became the Faculty of Applied Science and Engineering of the University of Toronto.

On April 8th, 1892, the Senate of the University established the Degree of B.A.Sc., which was open to those who held the Diploma of the School and were prepared to devote a fourth year to advanced work. In the Session of 1909-1910 a new course extending over four years and leading to the Degree of B.A.Sc., came into operation, taking the place of the long established diploma course of three years, which came to an end in the Session 1910-1911. In the session 1923-1924 the Degree of B.Arch. was offered to students in Architecture.

SECTION V. ADMISSION AND REGISTRATION

Inquiries about admission to this Faculty should be sent to the Registrar of the University.

GENERAL

1. Candidates for admission in 1945 to the Faculty of Applied Science and Engineering must submit the certificates listed below as evidence that they are qualified to take one of the courses of instruction and proceed to a degree. Applicants must also submit a certificate of good character, and must have completed the seventeenth year of their age. The procedure for application and registration is described in paragraph 8 below.

2. In general, the holding of any of the following classes of certificate will constitute qualification for admission to this Faculty.

(*a*) The Ontario Secondary School Graduation Diploma in either the General Course or the Vocational Course (Industrial Department), and the Ontario Grade XIII certificate as described in paragraph 3 below.

(*b*) Certificates of having passed certain equivalent examinations as described in paragraph 5 below.

(*c*) Certificates of undergraduate work in other universities. See admission to advanced standing, paragraphs 6 and 7 below.

The Senate will consider applications for the recognition of certificates other than those mentioned as occasion may require. Such certificates must be accompanied by an official statement of the marks in the various subjects upon which the certificate was granted.

3. SECONDARY SCHOOL GRADUATION DIPLOMA

No subjects are definitely prescribed, but the diploma must show credit for **four** optional subjects.

GRADE XIII

ENGLISH
MATHEMATICS (Algebra, Geometry, Trigonometry)
SCIENCE (Chemistry and Physics)
One of FRENCH
GERMAN
GREEK
ITALIAN
LATIN
SPANISH

It is highly desirable that applicants for admission should have a good standing in Mathematics (Algebra, Geometry, Trigonometry).

A candidate applying to enter the course in Engineering Physics must have met the regular requirements for admission to the faculty and, in

addition, have obtained an average of seventy-five per cent. in Mathematics (Algebra, Geometry, and Trigonometry) of the Grade XIII examination. A candidate whose general proficiency record in other subjects is not considered by the Council to be sufficiently high will not be admitted.

A candidate applying to enter the course in Aeronautical Engineering must have met the regular requirements for admission to the Faculty, and, in addition, must have good standing in Mathematics and Science. A candidate whose general proficiency record in other subjects is not considered by the Council to be sufficiently high will not be admitted to the course.

4. Those intending to enter the course in Architecture are recommended to select French as one of the admission subjects; those intending to enter Chemical, Civil, Electrical, Mechanical, Metallurgical Engineering, or Engineering Physics are recommended to select German.

EQUIVALENT CERTIFICATES

5. Certificates of the following examinations recognized as equivalent in value to the Ontario Secondary School Graduation Diploma and Grade XIII certificate may be accepted in so far as they meet the admission requirements of the University of Toronto and conform to the admission requirements of the universities of the respective provinces. A candidate applying for admission on such certificates must submit an official statement of the marks upon which these certificates were awarded.

PROVINCE OF ONTARIO

The Middle School Certificate now known as the Grade XII certificate or the Secondary School Graduation Diploma; the Upper School or Grade XIII certificate.

PROVINCE OF QUEBEC

Quebec High School Leaving and Senior High School Leaving certificates; the Junior and Senior Matriculation certificates of McGill University.

PROVINCE OF NEW BRUNSWICK

Junior and Senior Matriculation certificates.

PROVINCE OF NOVA SCOTIA

High School certificates of Grade XI and Grade XII issued by the Department of Education.

PROVINCE OF MANITOBA

The Junior (Grade XI) and Senior (Grade XII) Matriculation certificates.

PROVINCE OF BRITISH COLUMBIA

The University Entrance or Junior Matriculation certificate and the Senior Matriculation certificate.

PROVINCE OF PRINCE EDWARD ISLAND

First Class License certificates issued by the Education Department or Honour Diplomas issued by the Prince of Wales College; Third Year certificates issued by the above College.

PROVINCE OF ALBERTA

The Junior (Grade XI) and Senior (Grade XII) Matriculation certificates.

PROVINCE OF SASKATCHEWAN

The Junior (Grade XI) and Senior (Grade XII) Matriculation certificates.

NEWFOUNDLAND

Junior and Senior Associate diplomas of the Department of Education.

NEWFOUNDLAND AND THE MARITIME PROVINCES

Certificates of the Common Examining Board.

GREAT BRITAIN

Certificate of having passed, or having exemption from the Preliminary Examination of the Institution of Civil Engineers in the British Isles, or equivalent.

ADMISSION TO ADVANCED STANDING

6. An undergraduate of another university may be admitted to advanced standing on such conditions as the Senate, on the recommendation of the Council of the Faculty, may prescribe.

7. An applicant for admission to advanced standing must submit with his application for admission: (1) an official transcript of his record in the University from which he wishes to transfer, showing in detail the courses which he has completed, with his standing in each; (2) certificate of honourable dismissal; (3) calendar of the university giving a full description of these courses.

PROCEDURE FOR APPLICATION AND REGISTRATION

8. Candidates for admission should apply to the Registrar of the University for forms of applications for admission; they are required to fill in these forms in duplicate and return them to the Registrar *not later than* September 1st, together with the following: (*a*) the Ontario Secondary School Graduation Diploma in the General Course and the Ontario Grade XIII certificate; (*b*) any other evidence of ability to take the work proposed; (*c*) certificate of good character. Failure to make early application will result in delay and inconvenience for the candidate.

9. Every person admitted to the University as an undergraduate must, at the time of his or her first medical examination by the University Health Service, present satisfactory evidence of successful vaccination, or must be vaccinated by the examining physician.

10. Every student must register in person with the Secretary of the Faculty as prescribed on page 5 of the Calendar.

11. A student who fails to register as prescribed in clause 10, must petition the Council for permission to register late. The Council, however, reserves the right to refuse the permission, or to impose a penalty, such penalty to be reckoned at one dollar per day, or part thereof, that elapses between the close of registration as prescribed and the filing of the petition.

12. A petition for permission to register late must be accompanied by a deposit equal to the estimated amount of the penalty. Should the Council decide that no penalty is to be imposed, the deposit will be refunded.

SECTION VI. FEES, DEPOSITS AND EXPENSES

FEES

1. A student who desires to enrol in the Faculty of Applied Science and Engineering is required to pay at least the First Term Instalment of fees on or before the opening date of the session, and before he can receive his registration card from the Secretary of the Faculty. The amount of the First Term Instalment of fees or of the Total Fee for the session may be ascertained from the schedule of fees below.

2. The Second Term Instalment of fees, if not already paid, is payable on or before January 15th. After this date an additional fee of $1.00 a month will be imposed until the whole amount is paid. All fees for the session must have been paid in full before the student can be admitted to the annual examinations.

3. In order to avoid delay in registration at the opening of the session it is recommended that at least the First Term Instalment of fees be forwarded by mail as early as possible in September, together with a form, in duplicate, to be provided by the Secretary of the Faculty and filled out by the student, giving his full name, course, year, etc.

4. University fees are payable at the Office of the University Bursar, Simcoe Hall, which will be open for the receipt of fees from 9 a.m. to 5 p.m. daily from September 17th to 26th (Saturday, September 22nd, 9 a.m. to 12.30 p.m.), and from 9 a.m. to 1 p.m. daily except Saturday during the remainder of the session. Cheques in payment of these fees should be made payable to the University of Toronto at par in Toronto.

5. Each undergraduate enrolled in the Faculty of Applied Science and Engineering must pay annual fees to the University Bursar according to the schedule below; the total fee in each case is made up of the academic fee and incidental fees; all incidental fees are payable in the first term.

SCHEDULE OF FEES

Academic Year	*Academic Fee	†Incidental Fees	Total Fee (if paid in one instalment)	First Term Instalment	Second Term Instalment
Men					
First, Second, Third, Fourth, & Fifth.......	$250	$41	$291	$166	$128
Women					
First.........	$250	$27	$277	$152	$128
Second, Third, Fourth & Fifth	250	24	274	$149	128

*The Academic Fee includes the following fees:—
Tuition; Library, Laboratory Supply; and one Annual Examination.

†These Incidental Fees include the following fees:—
For men—Hart House; Students' Administrative Council; Athletic; Health Service; Physical Training; Engineering Society; Faculty Athletic Association; and Laboratory Deposit.
For women—Students' Administrative Council; Athletic; Health Service, Physical Training (for the First Year only); and Engineering Society; and Laboratory Deposit.

OTHER UNIVERSITY FEES

6. Each student is required to pay to the University Bursar at the opening of the session, or as otherwise specified, such of the following fees as may be required of him.

EQUIVALENT CERTIFICATE FEE

7. Each student who has been admitted to the First Year upon a certificate or certificates granted outside the Province of Ontario and covering all or any part of the admission requirements, must pay a fee of $5.00.

ADVANCED STANDING FEE

8. Each student who has been admitted to advanced standing from another university or college, must pay a fee of $10.00.

SUPPLEMENTAL PHYSICAL TRAINING FEE

9. Each student who has neglected to complete satisfactorily the course in Physical Training of the First or Second Year, and who must take this work during the Second or Third Years respectively of his or her attendance, must pay a fee of $10.00.

SUPPLEMENTAL EXAMINATION FEES

10. Each candidate for a supplemental examination is required to pay a fee to the Bursar not later than September 1st. The fee is $10.00 for either one or two supplemental examinations, including laboratory supplementals. For each supplemental examination in a laboratory subject requiring special supervision, there is an additional fee of $10.00. The additional laboratory supplemental fee should not be paid until the candidate is notified by the Secretary.

DEGREE FEE

11. Each candidate for the degree of Bachelor of Applied Science or Bachelor of Architecture must pay a fee of $10.00 to the Bursar on or before January 15th of his final year.

LABORATORY DEPOSIT

12. A laboratory breakage deposit of $10 is included in the incidental fees. This deposit, less charges for waste, neglect, and breakages will be refunded at the end of the session. Should the deposit be insufficient to meet the charges, a levy will be made to cover the deficiency.

SUMMARY OF STUDENTS' EXPENSES

13. The following approximate statement of expenses will give the student a general idea of the cost of obtaining an education in the Faculty of Applied Science and Engineering in the University of Toronto, exclusive of personal expenses:—

1. Fees, see schedule, page 21.
2. Board and Lodging, per week .... $ 8 to $10
3. Books and instruments, per year............... $35 to $45

SECTION VII. COURSES AND DEGREES

1. At the time of registration in the Faculty, the applicant is required to indicate the graduating course in which he intends to proceed to a degree. There are ten courses in Engineering, and the School of Architecture, from which the selection may be made, viz.,

Civil Engineering (Course 1),
Mining Engineering (Course 2),
Mechanical Engineering (Course 3),
Architecture (Course 4),
Engineering Physics (Course 5),
Chemical Engineering and Applied Chemistry (Course 6),
Electrical Engineering (Course 7),
Metallurgical Engineering (Course 8-8a).
Mining Geology (Course 9),
Aeronautical Engineering (Course 10).
Engineering and Business (Course 11).

2. The Degree of Bachelor of Applied Science will be awarded to students who complete one of the courses in Engineering, and Bachelor of Architecture to those who complete the course in Architecture.

3. The courses in Engineering extend over four academic years; the course in Architecture extends over five. A student must pass in the work of each academic year before proceeding to the work of the next. See Sec. X.

4. If, for any reason, an undergraduate wishes to change his course, he must petition the Faculty Council and obtain its approval. Such petition should be submitted by September 15, 1945.

5. Students must conform to all lecture room and laboratory regulations. Reports, briefs, theses, and drawings become the property of the Council to dispose of as it may see fit. Drawings, briefs, and field notes will not be accepted unless they have been made at the time and place provided in the time-table.

6. The curricula of the courses of instruction in Engineering and Architecture are given in Sec. IX.

7. Examinations are conducted as explained in Sec. X.

8. Students in Civil Engineering, Mining Engineering, Mechanical Engineering, Architecture, Electrical Engineering, and Mining Geology and Engineering and Business are required to have practical experience in offices, shops, or field, before their degree is granted. Students are asked to submit certificates of this experience as soon as possible after the completion of each period of work. (See Sec. IX.)

GRADUATE AND PROFESSIONAL DEGREES

1. Graduates in Engineering or Architecture may proceed to post-graduate and professional degrees. The post-graduate degrees are

M. Arch., M.A.Sc., and Ph.D. The professional degrees are C.E., Chem. E., E.E., M.E. (Mechanical Engineer), M.E. (Mining Engineer), and Met. E.

2. Bursaries and scholarships for graduate students are available in limited number as shown on page 149. In times of peace, many part-time demonstratorships are open which permit post-graduate work towards a degree.

3. The courses for these degrees are under the direction of the School of Graduate Studies, and candidates should send their inquiries to the Secretary of the School of Graduate Studies. Page 196 of this Calendar contains further information on graduate studies in Applied Science and Engineering.

ASSOCIATIONS OF PROFESSIONAL ENGINEERS

Graduation from the Faculty of Applied Science and Engineering leads to registration as a Professional Engineer in the various Associations of Professional Engineers throughout Canada.

SECTION VIII. SCHOOL OF ENGINEERING RESEARCH

THE SCHOOL

A School of Engineering Research, within the Faculty of Applied Science and Engineering, was established in the Spring of 1917 at the suggestion of the late Dean Ellis.

The School is under the direct supervision of a Committee of Management composed of members of the Faculty Council. To this Committee of the Council is entrusted the selection of researches to be undertaken under the auspices of the School, and the disposition of funds for conducting them.

The School was organized chiefly for the training of graduates in methods of research and for the carrying out of investigations. These latter may be problems relating to specific industries of raw materials and having a specific end in view, or general problems having to do with fundamental principles.

RESEARCH ASSISTANTS

A number of research assistants in the School of Engineering Research are appointed annually on salary in the various departments of the Faculty to carry on the work of research under direction of members of the staff. This work is accepted as partial fulfilment of the requirements for the degrees of M.A.Sc., M.Arch., and Ph.D. These research assistants are usually recent graduates, and are chosen from among those who have displayed special capacity for investigation in their undergraduate courses. Applicants should consult with members of the staff as soon as possible after the April examinations.

The facilities of the School are also open to graduates who desire to penetrate more deeply into particular phases of experimental work, or to undertake investigations either suggested by members of the staff or arising from their own work since graduation.

INQUIRIES

All communications should be sent to the Secretary of the Committee of Management, Mr. W. S. Wilson.

SECTION IX. CURRICULUM

The courses of instruction are designed to give the student a thorough grounding in the fundamentals of engineering or architecture, and, in addition, sufficient familiarity with the practical application of the principles to make him useful upon graduation. The courses are very similar in the First Year with the exception of those of Architecture, Engineering Physics, and Aeronautical Engineering. In the succeeding years specialization develops to some extent with provision in the Third and Fourth years for optional subjects in some of the graduating courses.

In the teaching of fundamentals, instruction is not confined wholly to Applied Science. As the future engineer is vitally concerned with the development of the country, it is essential that he be instructed in the rudiments of economics, administration, and business, which, with his scientific training, will enable him to increase his usefulness to the full.

In some graduating courses, laboratory work in the Fourth Year consists of the investigation of some specific problem. In all instances the student's knowledge of the original literature and primary sources of information is extended, and he is given a very desirable and useful training in methods of research. In this way the undergraduate course is linked with the graduate courses (page 196), and with the work of the School of Engineering Research (page 25).

As part of the laboratory instruction, excursions to places of technical interest, both in Toronto and elsewhere, are arranged by the staff. These excursions are treated as laboratory periods with the same requirements as to attendance and reports. The total transportation costs in any one year will probably not exceed ten dollars.

On the following pages of this section, the curriculum for each course is set forth in detail. The time devoted to lectures and practical work is indicated as accurately as possible, but is subject to modification as occasion may require. The program and regulations regarding the courses of study and examination, contained in this Calendar, hold good for this academic year only, and the Faculty of Applied Science and Engineering does not bind itself to adhere for the whole period of a student's course to the conditions here laid down.

Communications relating to curricula, instruction, and examinations in the Faculty of Applied Science and Engineering should be sent to the Secretary of the Faculty.

For information regarding the courses of study leading to the post-graduate degrees, Master of Applied Science, Master of Architecture, and Doctor of Philosophy, see pages 196 and 197 of this calendar, and the calendar of the School of Graduate Studies, which gives full particulars.

CIVIL ENGINEERING

(COURSE 1)

The normal course in Civil Engineering has been so designed as to be broad and comprehensive, with a view to meeting not only the needs of those who have definitely decided to enter this branch of the profession, but also of those who desire a technical training of such a basic character as to enable them to enter various other fields of technical employment. Concurrent with the instruction in engineering subjects, sufficient attention is given to economic, legal, and administrative matters to make the graduate in this course fitted to enter not only upon such work as Municipal Engineering, Sanitary Engineering, Highway Engineering, Railway Engineering, Geodetic Surveying, Structural Engineering, and Hydraulic Engineering, but also upon administrative and executive work in both engineering and industrial undertakings.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Analytical Geometry, 492, page 127.

PRACTICAL EXPERIENCE

Before receiving the degree, every student in Civil Engineering is required to submit satisfactory evidence of having had at least 600 hours of practical experience. (See subject 690).

GRADUATE STUDY

Graduates of this University, or of other universities of comparable standing, who have taken the above mentioned or similar course with sufficiently high records may proceed with work leading to a graduate degree.

The time devoted to graduate study is divided between work on the subjects of mathematics, physics, fundamentals of civil engineering and related work on the approved civil engineering field of investigation chosen by the candidate.

Further information appears on page 196. The Calendar of the School of Graduate Studies should be consulted for details.

FIRST YEAR SUBJECTS COURSE 1	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry	492 275	1	1	2	1
Calculus	490, 275	2	2	2	2
Chemistry	221, 222	2	–	2	6
Descriptive Geometry	270	1	–	1	–
Dynamics	21, 275	1	1	2	1
Electricity	330	2	–	2	–
Engineering and Society	322	1	–	1	–
Engineering Problems and Drawing	275	–	9	–	4
English	610	1	–	1	–
Physical Training	640	–	2	–	2
Practical Experience	690	–	–	–	–
Statics	20, 275	1	1	2	1
Surveying	710, 712	1	3	–	–

SECOND YEAR SUBJECTS COURSE 1	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Alternating Currents	331, 350	1	–	1	3
Applied Physics	75, 76	1	3	1	3
Calculus	491	2	–	2	–
Descriptive Geometry	272	2	–	–	–
Dynamics	22	1	–	1	–
Economics	311	2	–	2	–
Engineering Chemistry	233	2	–	–	–
Engineering Problems and Drawing	284	–	8	–	8
Hydraulics, Elementary	447	–	–	1	–
Least Squares	494	–	–	1	–
Mechanics of Materials	23, 31	2	–	2	3
Physical Training	640	–	2	–	2
Practical Astronomy	200	–	–	2	–
Practical Experience	690	–	–	–	–
Spherical Trigonometry	493	1	–	–	–
Surveying	714, 716	1	8	1	–

THIRD YEAR SUBJECTS COURSE 1	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Applied Elasticity	33	1	–	1	–
Astronomy and Geodesy	201	–	–	2	–
Business	310	–	–	1	–
Cements and Concrete	35, 44	1	2	1	–
Construction Surveying	717	1	–	1	–
Descriptive Geometry	274	1	–	–	–
Differential Equations	507	1	1	1	1
Elementary Structural Engineering	28	2	–	2	–
Engineering Problems and Drawing	291	–	10	–	9
Engineering Geology	385, 386	1	–	2	2
Heat Engines, Theory	427, 428	1	–	1	2
Hydraulics	440, 441	2	–	2	3
Machinery	463, 464	2	3	–	–
Modern World History	324	1	–	1	–
Petrography	582	1	1	–	–
Photographic Surveying	81	1	–	–	–
Physical Metallurgy	546	–	–	1	–
Political Science	323	1	–	1	–
Practical Experience	690	–	–	–	–
Survey Camp	720	–	–	–	–

Before entering the Fourth Year, all students must select which one of the five elective subjects they propose to study. Information regarding these subjects will be given at the end of the Third Year. Although required to take an examination in only one of the five subjects, students are encouraged to attend lectures in the subjects other than the ones they select, when this is possible.

FOURTH YEAR SUBJECTS COURSE 1	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Contracts and Specifications	315	–	–	1	–
Engineering Economics	313	–	–	1	–
Engineering Law	314	1	–	–	–
Foundations	39, 298	1	–	1	2
Hydraulics	445, 446	1	3	1	–
Management	316	1	–	1	–
Mechanics of Materials Lab.	38, 50	–	3	–	6
Modern Political and Economic Trends	325	1	–	1	–
Philosophy of Science	326	1	–	½	–
Practical Experience	690	–	–	–	–
Profession of Engineering	327	–	–	½	–
Soil Mechanics	40	1	–	–	–
Reinforced Concrete	41, 298	1		1	
Structural Design	43, 298	2	6	1	6
Theory of Structures	36, 298	1		1	
Thesis	730	–	3	–	3
And *one* of the following Elective Subjects:					
1a. Advanced Structural Engineering	34, 37,	2	5	2	4
1b. Advanced and Photographic Surveying	82, 83, 718, 719	2	5	2	4
1c. Municipal Engineering	215, 301				
1d. Transportation		2	5	2	4
Engineering	216	2	5	2	4
1e. Water Power Engineering	217, 444	2	5	2	4

MINING ENGINEERING

(COURSE 2)

The course in Mining Engineering, which originated in 1878 as a course in Assaying and Mining Geology, is intended to serve as a preliminary training for those who expect to practise in some branch of Mining Engineering, such as exploration of mining areas and primary development; mine surveying; mining processes involving civil, mechanical and electrical work; underground operations; mining machinery and operation; milling and treatment of ores; assaying and other forms of analysis and research; and administrative work in both engineering and industrial undertakings.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Analytical Geometry, 492, page 127.

PRACTICAL EXPERIENCE

Before receiving the degree, every student in Mining Engineering is required to present satisfactory evidence of having had at least six months' practical experience. (See subject 691.)

GRADUATE STUDY

Graduates of this University, or of another university of comparable standing, who have taken the above course with a sufficiently good standing may proceed with work leading to a graduate degree.

The major portion of the student's time will be devoted to research work on some subject approved by the Department, but certain specified courses of instruction must also be taken, in which examinations are demanded.

Further information appears on page 196 of this Calendar. The Calendar of the School of Graduate Studies should be consulted for details.

First Year Subjects Course 2	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry	492	1	–	2	–
Calculus	490	2	–	2	–
Chemistry	221, 222	2	6	2	6
Descriptive Geometry	270	1	–	1	–
Dynamics	21	1	–	2	–
Electricity	330	2	–	2	–
Engineering and Society	322	1	–	1	–
Engineering Problems and Drawing	276	–	6	–	6
English	610	1	–	1	–
Mechanical and Thermal Measurements	448	–	–	2	–
Mineralogy, Elementary	580, 583	–	–	2	1
Mining Laboratory	165	–	2	–	–
Physical Training	640	–	2	–	2
Practical Experience	691	–	–	–	–
Statics	20	1	–	2	–
Surveying	710, 712	1	3	–	–

Second Year Subjects Course 2	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Alternating Currents	331, 350	1	–	1	3
Analytical Chemistry Laboratory	227	–	–	–	3
Blowpipe Analysis	589	–	–	–	2
Chemistry	224	1	–	1	–
Descriptive Geometry	272	2	–	–	–
Economics	311	2	–	2	–
Engineering Problems and Drawing	285	–	8	–	8
General Geology	388, 389	2	–	1	2
Heat Engines, Elementary	420	1	–	–	–
Mechanics of Materials	23, 31	2	–	2	3

SECOND YEAR SUBJECTS COURSE 2—*Continued*	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Mining	167	1	–	–	–
Optical Mineralogy, Elementary	597	–	–	1	–
Petrography	587	1	–	–	1
Physical Training	640	–	2	–	2
Practical Experience	691	–	–	–	–
Problems and Seminar	186	–	2	–	–
Surveying	715, 716	1	6	1	–
Theory of Measurements	182	1	–	–	–

THIRD YEAR SUBJECTS COURSE 2	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Chemistry	225, 237	1	3	1	3
Assaying	160, 161	1	3	–	3
Business	310	–	–	1	–
Economic Geology	399	1	–	2	–
Electrical Machinery	348	2	–	–	–
Elementary Structural Engineering	29	1	–	1	–
Engineering Problems and Drawing	292	–	3	–	3
Geological Field Work	380	–	–	–	–
Hydraulics	440, 441	2	1½	–	–
Introductory Research	183	–	–	–	3
Metallurgy	530	1	–	–	–
Mining	170	1	–	1	–
Modern World History	324	1	–	1	–
Ore Dressing	175, 176	–	–	2	6
Petrography, General	595, 596	–	–	1	2
Physical Metallurgy	546, 549	–	–	1	1
Political Science	323	1	–	1	–
Practical Experience	691	–	–	–	–
Principles of Ore Dressing	181	2	–	–	–
Problems and Seminar	186	–	2	–	–
Structural Geology	390, 391	2	3	–	–
Summer Letters	184	–	–	–	–
Survey Camp	720	–	–	–	–

FOURTH YEAR SUBJECTS COURSE 2	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Assaying	162, 163	–	–	1	3
Engineering Economics	313	–	–	1	–
Geology, Precambrian	392	2	–	–	–
Geology, Mining	396	–	–	2	–
Geology, Pleistocene and Physiographic	381, 382	1	1	1	–
Heat Engines, Theory	427, 428	1	1½	1	–
Hydraulics	451	–	–	1	–
Machine Design	469, 470	1	–	1	3
Metallurgy	538, 539	1	–	1	3
Mine Management	172	2	–	–	–
Mine Ventilation	173, 174	2	3	–	–
Mining	166, 171	–	–	2	3
Modern Political and Economic Trends	325	1	–	1	–
Ore Dressing	177, 178	1	6	1	–
Practical Experience	691	–	–	–	–
Profession of Engineering	327	–	–	½	–
Problems and Seminar	186	–	2	–	–
Philosophy of Science	326	1	–	½	–
Summer Essays	185	–	–	2	–
Thesis	731	–	6½	–	5

MECHANICAL ENGINEERING

(COURSE 3)

The mechanical engineer is concerned with the production and the use of power; and it is part of his work to design and manufacture suitable machinery for this purpose, and to install and operate it. The internal combustion engine and the steam turbine are the products of his effort, and he applies these prime movers to automobiles, aeroplanes, locomotives, and other purposes. His work also includes the design of water turbines and their use in hydro-electric systems.

Other branches of his work are the making of designs for air compressors, machine tools, pumps, refrigerating machines and their application to storage warehouses and ice-making, heating and ventilating equipment, materials-handling and conveying plants, and generally all mechanical work. General industrial and administrative problems are considered.

An effort is also being made to help qualified students interested in the design of high speed trains and cars.

The course of study has been devised to equip men for work in the general field of mechanical and industrial engineering.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Analytical Geometry, 492, page 127.

SHOP WORK

Before receiving the degree, every student in Mechanical Engineering is required to spend 1200 hours in mechanical shops, either prior to entering or during the vacations. (See subject 692.)

GRADUATE STUDY

Graduates of this University, or of another university of comparable standing, who have taken the above course, or one similar, with a sufficiently good standing may proceed with work leading to a graduate degree.

Some part of the instructional period will be devoted to advanced work in Mathematics and the Fundamentals of Engineering. The remainder of the time will be given to a study of some specific branch of Mechanical Engineering work or to some definite Mechanical problem.

Further information appears on page 196. The Calendar of the School of Graduate Studies should be consulted for details.

FIRST YEAR SUBJECTS COURSE 3	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry........	492, 277	1	1	2	1
Calculus..................	490, 277	2	2	2	2
Chemistry.................	221, 222	2	6	2	–
Descriptive Geometry.......	270	1	–	1	–
Dynamics..................	21, 277	1	1	2	1
Electricity................	330	2	–	2	–
Engineering and Society......	322	1	–	1	–
Engineering Problems and Drawing................	277	–	3	–	10
English...................	610	1	–	1	–
Mechanical and Thermal Measurements...........	448	–	–	2	–
Physical Training...........	640	–	2	–	2
Practical Experience.........	692	–	–	–	–
Statics....................	20	1	1	2	1
Surveying..................	710, 712	1	3	–	–

SECOND YEAR SUBJECTS COURSE 3	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Calculus..................	491	2	–	2	–
Descriptive Geometry.......	272	2	–	–	–
Direct Current Machines.....	338	–	–	2	3
Dynamics..................	22	1	–	1	–
Economics.................	311	2	–	2	–
Electricity................	332, 334	2	3	–	–
Engineering Chemistry.......	226	2	–	–	–
Engineering Problems and Drawing................	286	–	8	–	12
Heat Engines, Elementary....	420	–	–	2	–
Hydraulics, Elementary......	447	1	–	–	–
Mechanical Engineering......	461	–	–	2	–
Mechanics of Materials......	23, 31	2	3	2	–
Physical Training...........	640	–	2	–	2
Practical Experience.........	692	–	–	–	–
Properties of Fluids.........	449	1	–	1	–
Theory of Machines I........	465	2	–	2	–

THIRD YEAR SUBJECTS COURSE 3	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Alternating Current Machinery	345	–	–	2	–
Alternating Currents........	340	2	–	–	–
Business....................	310	–	–	1	–
Electrical Laboratory........	346	–	3	–	3
Elementary Structural Engineering.............	29, 293	1	3	1	3
Heat Engineering...........	422	2	–	2	–
Heat Engines, Theory.......	421, 423	2	3	2	3
Hydraulics.................	440, 441	2	–	2	3
Machine Design............	467, 468	2	9	2	6
Modern World History.......	324	1	–	1	–
Physical Metallurgy.........	533	–	–	2	–
Political Science............	323	1	–	1	–
Practical Experience.........	692	–	–	–	–
Theory of Machines II.......	466	2	–	–	–

FOURTH YEAR SUBJECTS COURSE 3	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Engineering Economics......	313	–	–	1	–
Engineering Law............	314	1	–	–	–
Heat Engine Laboratory.....	426	–	5	–	6
Heat Power Engineering.....	424	2	–	1	–
Heat Treatment of Iron and Steel..................	547, 548	1	–	1	1½
Hydraulics.................	442, 443, 444	2	5	3	6
Industrial Management......	318	1	–	1	–
Internal Combustion and Air-Craft Engines...........	425	1	–	1	–
Machine Design............	473, 474	2	5	2	6
Modern Political and Economic Trends........	325	1	–	1	–
Philosophy of Science........	326	1	–	½	–
Practical Experience.........	692	–	–	–	–
Profession of Engineering.....	327	–	–	½	–
Structural Engineering.......	46, 299	2	3	–	–
Thesis.....................	732	–	1	–	1

SCHOOL OF ARCHITECTURE

(COURSE 4)

The School of Architecture was established as a Department of the School of Practical Science, later the Faculty of Applied Science and Engineering, in 1890, and is one of the oldest schools in the British Empire. The School is fortunate in enjoying a close connection with the Ontario Association of Architects and the Royal Architectural Institute of Canada, both of which organizations offer prizes and scholarships for competition in the School.

The School is one of a limited number in the Empire recognized by the Royal Institute of British Architects, which admits graduates to Associate Membership on application, without examination. The Ontario Association of Architects, through its Registration Board, accepts the degree in Architecture, coupled with a twelve months period of office experience with an architect, as qualification to practise the profession of Architecture in the Province of Ontario. As a matter of fact, few graduates commence practice without a continuation of their practical training, and a year or two years' travel or additional experience in the employ of an architect is recommended.

An event in the academic year is the period at Gull Lake, a University Camp, where a week is spent under supervision, sketching out of doors.

It becomes increasingly clear that in the modern movement in Architecture, the architect must more and more be the "master builder" or the "architect" in the original meaning of that term. His interests are no longer confined to plans, elevations and specifications though those remain an important part of his job. With this new viewpoint in mind, structural subjects such as reinforced concrete and steel construction are given greater space and importance in all years. Positions in which architects find themselves in war work and will find themselves in post-war period, require such a knowledge to a greater extent, and students are being trained for such employment.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects, referring to a more detailed description, *e.g.*, History of Architecture, 110, page 83.

PRACTICAL EXPERIENCE

Before receiving the degree, every student in the School of Architecture is required to submit satisfactory evidence of having had 12 months' (1900 hours) practical experience. (See subject 693.)

First Year Subjects Course 4	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Studio	Lect.	Studio
Analytical Geometry........	492	1	–	2	–
Calculus...................	490	2	–	2	–
Architectural Drawing.......	121	–	14	–	15
Building Construction.......	140	–	–	1	–
Descriptive Geometry.......	270	1	–	1	–
Elements of Arch. Form......	118	1	–	1	–
Engineering and Society......	322	1	–	1	–
Engineering Problems and Drawing................	278	–	3	–	3
English....................	610	1	–	1	1
Freehand Drawing..........	131	–	2	–	2
History of Architecture......	110	1	–	1	–
Physical Training...........	640	–	2	–	2
Practical Experience.........	693	–	–	–	–
Statics.....................	20	1	–	2	–
Surveying..................	711	1	3	–	–

Second Year Subjects Course 4	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Studio	Lect.	Studio
Architectural Design........	122	–	15	–	21
Colour.....................	136	1	–	–	–
Descriptive Geometry.......	272	2	–	–	–
Economics..................	311	2	–	2	–
Freehand Drawing..........	132	–	2	–	2
History of Architecture......	111	1	–	1	–
Mechanics of Materials......	23	2	–	2	–
Modelling..................	137	–	2	–	2
Photography...............	77, 78	1	3	–	–
Physical Training...........	640	–	2	–	2
Practical Experience.........	693	–	–	–	–
Theory of Arch. Planning....	128	1	–	1	–

THIRD YEAR SUBJECTS COURSE 4	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Studio	Lect.	Studio
Architectural Design	123	–	15	–	18
Commercial Law	312	1	–	1	–
Freehand Drawing	133	–	2	–	2
Functional Requirements of Buildings	115	½	–	½	–
Garden Design	116	½	–	–	–
History of Architecture A	112	1	–	–	–
History of Architecture B	113	–	–	1	–
History of Sculpture	120	1	–	–	–
Light and Acoustics	85, 86	1	2	1	2
Measured Drawings	147	–	–	–	–
Modelling	138	–	2	–	2
Modern World History	324	1	–	1	–
Political Science	323	1	–	1	–
Practical Experience	693	–	–	–	–
Public Speaking	320	1	–	1	–
Structural Design	30	2	3	2	3

FOURTH YEAR SUBJECTS COURSE 4	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Studio	Lect.	Studio
Architectural Design	124	–	17	–	17
Building Materials					
Stones	405	1	–	–	–
Ceramic	569	1	–	1	–
Architectural Application	141	–	–	1	–
Contracts and Specifications	315	–	–	1	–
Foundations	39	1	–	1	–
Freehand Drawing	134	–	2	–	2
Garden Design	116	½	–	–	–
History of Painting	119	1	–	1	–
Housing	130	1	–	–	–
Illumination Design	87, 88	1	1	1	1
Modelling	139	–	2	–	2
Modern Political and Economic Trends	325	1	–	1	–
Practical Experience	693	–	–	–	–
Outdoor Sketches	148	–	–	–	–
Sanitary Science	142	1	–	1	–
Structural Design	42	1	3	1	3

FIFTH YEAR SUBJECTS COURSE 4	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Studio	Lect.	Studio
Architectural Design	125	–	23	–	25
Architectural Economics	145	1	–	1	–
Garden Design	116	½	–	–	–
Heating and Air Conditioning	144	1	–	1	–
Housing	130	1	–	–	–
Philosophy of Science	326	1	–	½	–
Practical Experience	693	–	–	–	–
Professional Practice	143	1	–	1	–
Structural Design	47	1	3	1	3
Town Planning	117	–	–	–	1

ENGINEERING PHYSICS

(COURSE 5)

Admission to and promotion in this course is granted only to students who meet the special requirements set forth on pages 17 and 147 of this Calendar.

The course is designed to afford a training in Mathematics and Physics beyond that which it is possible to give in the other undergraduate courses in engineering. It is believed that a wider and more thorough acquaintance with the basic sciences will bring to the student a readier appreciation of the nature of the technical problems with which he will later be confronted and a greater facility in the solution of them. A course of the kind offered should consequently be of particular value to those who desire to enter governmental or industrial research laboratories, or who wish to engage in any original work of investigation or development in the field of applied physics.

Throughout the four years of the course an effort is made to maintain the practical point of view in the theoretical instruction. This is effected, in part, by adopting wherever possible the engineering viewpoint in the teaching of mathematical and scientific subjects, and, in part, by the inclusion of certain basic engineering instruction.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Algebra and Calculus, 502, page 127.

FIRST YEAR SUBJECTS COURSE 5	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Algebra and Calculus	502	$3\frac{1}{2}$	–	$3\frac{1}{2}$	–
Analytical Geometry	503	$1\frac{1}{2}$	–	$1\frac{1}{2}$	–
Applied Mechanics	24	2	–	2	–
Chemistry	221, 222	2	3	2	3
Descriptive Geometry	270	1	–	1	–
Electricity	330	2	–	2	–
Engineering and Society	322	1	–	1	–
Engineering Problems and Drawing	279	–	3	–	6
English	610	1	–	1	–
Physical Training	640	–	2	–	2
Properties of Matter, Mechanics and Heat	650, 651	4	3	4	3
Surveying	710, 712	1	3	–	–

SECOND YEAR SUBJECTS COURSE 5	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Acoustics	654	1	–	–	–
Analytical Geometry of Space	506	1	–	1	–
Descriptive Geometry	272	2	–	–	–
Differential Calculus	504	3	–	3	–
Dynamics	22	1	–	1	–
Economics	311	2	–	2	–
Electricity	332, 334	2	3	–	–
Elementary Light	653	1	–	1	–
Elementary Machine Design	471, 472	1	3	1	3
Elementary Magnetism and Electricity	652	1	–	2	–
Integral Calculus and Differential Equations	505	3	–	3	–
Mechanics of Materials	23, 31	2	–	2	3
Organic Chemistry	250	1	–	1	–
Physics Laboratory	655	–	3	–	6
Physical Training	640	–	2	–	2

Students in Engineering Physics are required to state at the beginning of the Third Year the options they desire to pursue in the Third and Fourth Years. Permission to enter upon an option must be sought from the Council. This may be withheld if the number of students offering, or conditions existing at the time, render it impracticable to give the work.

THIRD YEAR SUBJECTS COURSE 5	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Differential Equations	507	1	1	1	1
Direct Current Machines	339	2	–	–	–
Heat	658	1	–	1	–
Mathematical Operations Applied to Physics	656	1	–	1	–
Modern World History	324	1	–	1	–
Physical Laboratory	659	–	3	–	3
Physical Metallurgy	533	–	–	2	–
Political Science	323	1	–	1	–
Properties of Matter	657	2	–	2	–
Theoretical Mechanics	520	1	1	1	1
Theory of Functions	508	1	1	1	1

And *one* of the following options which must be continued in the Fourth Year.

Option 5c, Electricity and Communications					
Option 5s, X-Rays and Spectroscopy					
Option 5i, Illumination and Acoustics					
Alternating Currents	341	2	–	2	–
Electrical Design	342	2	–	–	–
Electrical Laboratory	344	–	6	–	6
Geometrical Optics	660,661	–	–	1	3
Photometry	79,80	1	3	–	–
Electronics	337	–	–	3	–
Option 5g, Geophysics					
Alternating Currents	341	2	–	2	–
Electrical Laboratory	344	–	6	–	6
Engineering Geology	385,386	1	–	2	2
Mineralogy, Elementary	598,599	2	1	–	–
Optical Mineralogy, Elementary	597	–	–	1	–
Petrography, Elementary	587	1	–	–	1
Photometry	79,80	1	3	–	–

THIRD YEAR SUBJECTS COURSE 5	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Option 5r, Refrigeration					
Alternating Current	340	2	–	–	–
Electrical Laboratory	347	–	3	–	3
Elementary Structural Engineering	29, 296	1	–	1	3
Properties of Living Matter	210	2	–	2	–
Theory of Heat Engines	421, 423	2	3	2	3

FOURTH YEAR SUBJECTS COURSE 5	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Option 5c, Electricity and Communications					
Acoustics	97	1	–	–	–
Acoustics, Advanced	664	1	–	–	–
Alternating Current Circuit Analysis	351	2	–	2	–
Communication	361, 362	2	3	2	3
Differential Equations of Mathematical Physics	521	2	–	2	–
Electrical Laboratory	356	–	6	–	6
Electrical Transmission of Energy	352	2	–	–	–
Electromagnetic Theory, Applied	365	2	–	2	–
Introduction to Atomic and Molecular Physics	663	1	–	1	–
Modern Political and Economic Trends	325	1	–	1	–
Operational Methods	364	2	–	2	–
Philosophy of Science	326	1	–	½	–
Physical Laboratory	665	–	3	–	3
Profession of Engineering	327	–	–	½	–
Thesis	733	–	–	–	–
Option 5s, X-Rays and Spectroscopy					
Acoustics	97	1	–	–	–
Acoustics, Advanced	664	1	–	–	–
Analysis of Materials by Spectrographic and X-ray Methods	669	1	–	1	–
Communication	361, 362	2	3	2	3
Differential Equations of Mathematical Physics	521	2	–	2	–
Electromagnetic Theory, Applied	365	2	–	2	–
Elementary Quantum Theory	668	1	–	–	–
Introduction to Atomic and Molecular Physics	663	1	–	1	–
Modern Political and Economic Trends	325	1	–	1	–
Morphological Crystallography	594	1	–	1	–

FOURTH YEAR SUBJECTS COURSE 5	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Option 5s, X-Rays and Spectroscopy (continued)					
Operational Methods	364	2	–	2	–
Optics, Advanced	666	1	–	1	–
Philosophy of Science	326	1	–	½	–
Physical Laboratory	665	–	9	–	9
Profession of Engineering	327	–	–	½	–
Series Spectra	667	–	–	1	–
Thesis	733	–	–	–	–
Option 5g, Geophysics					
Differential Equations of Mathematical Physics	521	2	–	2	–
Economic Geology	398, 400	1	3	3	3
Electromagnetic Theory, Applied	365	2	–	2	–
Geophysics	670, 671	2	9	2	9
Location of Mineral Deposits	401	–	–	1	–
Modern Political and Economic Trends	325	1	–	1	–
Petrography, General	590, 591	1	2	1	2
Philosophy of Science	326	1	–	½	–
Physics of the Earth	672	2	–	2	–
Profession of Engineering	327	–	–	½	–
Structural Geology	390, 391	2	3	–	3
Thesis	733	–	–	–	–

FOURTH YEAR SUBJECTS COURSE 5	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Option 5i, Illumination and Acoustics					
Acoustics, Advanced	664	1	–	–	–
Architectural Acoustics	89,90	1	3	3	9
Communication	361, 362	2	3	–	–
Differential Equations of Mathematical Physics	521	2	–	2	–
Modern Political and Economic Trends	325	1	–	1	–
Operational Methods	364	2	–	2	–
Philosophy of Science	326	1	–	½	–
Photometry and Illumination Design	95, 96	2	6	2	6
Physical Laboratory	674	–	3	–	3
Physics of Light Production	673	1	–	1	–
Profession of Engineering	327	–	–	½	–
Option 5r, Refrigeration					
Alternating Current Machinery	353, 367	2	3	2	–
Differential Equations of Mathematical Physics	521	2	–	2	–
Electronics	337, 368	–	–	3	3
Heat Power Engineering	424, 426	2	5	1	6
Heat Transfer and Refrigeration	429	2	–	2	–
Internal Combustion Engines	425	1	–	1	–
Low Temperature Physiology	211, 212	1	3	1	3
Modern Political and Economic Trends	325	1	–	1	–
Philosophy of Science	326	1	–	½	–
Physics of Light Production	673	1	–	1	–
Profession of Engineering	327	–	–	½	–
Thesis	733	–	–	–	–
Vibration Engineering	99, 100	1	3	1	3

CHEMICAL ENGINEERING AND APPLIED CHEMISTRY

(COURSE 6)

The course is designed to give the student a thorough training in the underlying principles and laboratory methods of inorganic, organic, physical, and analytical chemistry, in the applications of these to industrial chemistry and chemical engineering, and a general knowledge of the elements of thermodynamics, hydraulics, machine design, structural design, electricity, and metallurgy. A preliminary training of this nature with subsequent practical experience will enable him to undertake the design and construction, also the operation and management of the plant required in such branches of chemical industry as are concerned with the production of chemical and pharmaceutical products, petroleum and its products, rubber goods, leather and glue, soap, meat products, foodstuffs, vegetable and animal oils, sugar, pulp and paper, vegetable and animal fibres, artificial silk, plastics, coal tar and wood distillates, paints and varnishes, explosives, dyes, portland cement, metals and their alloys, electrochemical products, fermentation products, fertilizers, synthetic chemical products, etc.

For those who by temperament and ability are attracted to chemical research there exist excellent opportunities in government, industrial, and medical research laboratories. Properly qualified students wishing to pursue experimental investigation as a life-work, whether in industrial chemistry or in purely scientific chemistry, may proceed in this department to the degrees M.A.Sc. and Ph.D., the laboratory research work of the Fourth Year serving as a connecting link between the undergraduate and graduate courses.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Analytical Geometry, 492, page 127.

GRADUATE STUDY

Graduates of this University, or of another university of comparable standing, who have taken the above course, or one similar, with a sufficiently good standing may proceed with work leading to a graduate degree.

Students wishing to pursue further studies, whether in chemical engineering, industrial chemistry, or in pure scientific chemistry, may proceed in the Department of Chemical Engineering to the degrees M.A.Sc. and Ph.D.

The major portion of the student's time will be devoted to research work assigned by the Department, but certain specified courses of instruction must be taken in which examinations are demanded.

Further information appears on page 196 of this Calendar. The Calendar of the School of Graduate Studies should be consulted for details.

FIRST YEAR SUBJECTS COURSE 6	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry	492	1	–	2	–
Calculus	490	2	–	2	–
Chemistry	221, 222	2	9	2	6
Descriptive Geometry	270	1	–	1	–
Dynamics	21	1	–	2	–
Electricity	330	2	–	2	–
Engineering and Society	322	1	–	1	–
Engineering Problems and Drawing	280	–	2	–	6
English	610	1	–	1	–
Mechanical and Thermal Measurements	448	–	–	2	–
Mineralogy, Introductory	581	–	–	1	1
Physical Training	640	–	2	–	2
Statics	20	1	–	2	–
Surveying	710, 712	1	3	–	–

SECOND YEAR SUBJECTS COURSE 6	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Calculus	491	2	–	2	–
Chemical Laboratory	229	–	–	–	–
Economics	311	2	–	2	-
Electricity	332, 334	2	3	–	–
Elementary Machine Design	462	–	–	2	–
Engineering Problems and Drawing	287	–	3	–	6
German*	613	1	–	1	–
Hydraulics, Elementary	447	1	–	–	–
Industrial Chemistry	231, 232	1	11	2	–

*Students who cannot present Junior Matriculation certificates in German will be required to attend tutorial class, 1 hour per week, both terms (time to be taken from Chemical Laboratory), and to pass an examination in this language. Those who hold certificates will not be required to take this course.

SECOND YEAR SUBJECTS COURSE 6—*Continued*	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Inorganic Chemistry........	223	1	–	1	–
Mechanics of Materials......	23	2	–	2	–
Organic Chemistry..........	234, 235	2	–	2	10
Physical Chemistry.........	236	2	–	2	–
Physical Training...........	640	–	2	–	2

THIRD YEAR SUBJECTS COURSE 6	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Alternating Currents........	340, 349	2	3	–	–
Assaying Laboratory........	164	–	$1\frac{1}{2}$	–	–
Business...................	310	–	–	1	–
Chemical Engineering.......	242	2	–	–	–
Chemical Theory...........	240	–	–	2	–
Electrochemistry...........	246, 247	$1\frac{1}{2}$	$1\frac{1}{2}$	–	–
German....................	614	1	–	1	–
Heat Engines, Theory.......	421, 428	2	–	2	$1\frac{1}{2}$
Hydraulics.................	440, 441	2	$1\frac{1}{2}$	2	–
Industrial Chemistry........	241, 238	1	–	1	$13\frac{1}{2}$
Metallurgy, Physical........	546	–	–	1	–
Modern World History......	324	1	–	1	–
Optics.....................	72,73	1	–	1	3
Organic Chemistry..........	244, 245	2	$10\frac{1}{2}$	2	–
Political Science............	323	1	–	1	–

Fourth Year Subjects Course 6	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Chemical Engineering					
Thermodynamics	248	1	–	1	–
Chemical Laboratory	251	–	15	–	–
Chemical Theory	259	1	–	2	–
Engineering Law	314	1	–	–	–
German	615	1	–	1	–
Industrial Management	318	1	–	1	–
Machine Design	469, 470	1	–	1	3
Modern Political and					
Economic Trends	325	1	–	1	–
Organic Chemistry	249	1	–	1	–
Philosophy of Science	326	1	–	$\frac{1}{2}$	–
Profession of Engineering	327	–	–	$\frac{1}{2}$	–
Public Speaking	320	1	–	1	–
Thesis	734	–	–	–	–
and *one of*					
1. Industrial Chemistry:					
Chemical Engineering					
Problems	252	–	1	–	3
Chemical Engineering	253	1	–	1	–
Industrial Chemistry	258	1	–	–	–
Research	254	–	5	–	16
2. Electrochemistry	255, 256	1	6	1	19
3. Physical Metallurgy	543, 544, 545	2	6	1	19
4. Glass Technology	570, 571	2	6	1	19
5. Zymology	750	–	8	–	20

ELECTRICAL ENGINEERING

(Course 7)

In following his profession, an electrical engineer will find necessary a knowledge of many fields in addition to that of applying things electrical for the benefit of humanity. For this reason the course includes not only mathematics, mechanics, physics and chemistry, but also heat engines, hydraulics, theory of mechanisms, machine design, business, economics, engineering law, and other non-electrical subjects.

In the electrical field much time is given to the calculation of circuits of electric, magnetic, and dielectric types, methods of measurement of various quantities in direct and alternating current circuits, theory of generators, motors, magnets, and other apparatus, design, electrical transmission of energy, and many related matters of interest. A great variety of problems for solution is one means of developing understanding. In the Fourth Year the proportion of time given to electrical engineering is much greater than in earlier years.

A training of this nature should, with subsequent experience, enable a student to develop into a useful and valued member of the profession, whether his natural abilities lead him into technical, commercial, or administrative responsibilities.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Analytical Geometry, 492, page 127.

PRACTICAL EXPERIENCE

Before receiving the degree, every student in Electrical Engineering is required to submit satisfactory evidence of having had 1200 hours' practical experience. (See subject 695.)

GRADUATE STUDY

Graduates of this University, or of another university of recognized standing, who have taken the above course, or one similar, and who have a satisfactory academic record may proceed with work leading to a graduate degree.

About one-half of the time will be devoted to subjects chosen from mathematics, physics, and the fundamentals of electrical engineering. The other half may be devoted to power, electronics, or communications.

Further information appears on page 196. The Calendar of the School of Graduate Studies should be consulted for details.

First Year Subjects Course 7	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry........	492	1	1	2	1
Calculus..................	490	2	2	2	2
Chemistry.................	221, 222	2	–	2	6
Descriptive Geometry.......	270	1	–	1	–
Dynamics..................	21, 281	1	1	2	1
Electricity.................	330	2	–	2	–
Engineering and Society......	322	1	–	1	–
Engineering Problems and Drawing................	281	–	9	–	4
English....................	610	1	–	1	–
Mechanical and Thermal Measurements...........	448	–	–	2	–
Physical Training...........	640	–	2	–	2
Practical Experience.........	695	–	–	–	–
Statics....................	20, 281	1	1	2	1
Surveying..................	710, 712	1	3	–	–

Second Year Subjects Course 7	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Applied Physics.............	70,71	1	3	1	3
Calculus..................	491	2	3	2	3
Descriptive Geometry.......	272	2	–	–	–
Dynamics..................	22	1	–	1	–
Economics.................	311	2	–	2	–
Electrical Fundamentals......	333	2	–	2	–
Electrical Laboratory........	334	–	–	–	6
Electricity.................	332	–	–	2	–
Elementary Heat Engines....	420	1	–	–	–
Elementary Machine Design..	462	–	–	2	–
Engineering Chemistry.......	226	2	–	–	–
Engineering Problems and Drawing................	288	–	6	–	3
Hydraulics, Elementary......	447	–	–	1	–
Mechanics of Materials......	23, 31	2	3	2	–
Physical Training...........	640	–	2	–	2
Practical Experience.........	695	–	–	–	–

THIRD YEAR SUBJECTS COURSE 7	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Alternating Currents	341	2	–	2	–
Business	310	–	–	1	–
Direct Current Machines	339	2	–	–	–
Electrical Design	342	2	6	–	–
Electrical Problems and Seminar	343	–	3	–	3
Electrical Laboratory	344	–	6	–	3
Electronics	337	–	–	3	–
Heat Engines, Theory	421, 423	2	3	2	–
Hydraulics	440, 441	2	–	2	3
Machine Design	475, 468	2	–	2	3
Mathematical Applications in Electrical Engineering	336	–	–	3	–
Modern World History	324	1	–	1	–
Physical Metallurgy	533	–	–	2	–
Political Science	323	1	–	1	–
Practical Experience	695	–	–	–	–

Fourth Year Subjects Course 7	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Acoustics	98	1	–	–	–
Alternating Current Circuit Analysis	351	2	–	2	–
Alternating Current Machinery	353	2	–	2	–
Alternating Current Measurements	354	2	–	–	–
Communication	361, 362	2	3	2	3
Electrical Design	358	–	–	1	3
Electrical Laboratory	355	–	6	–	6
Electrical Transmission of Energy	352	2	–	–	–
Engineering Economics	313	–	–	1	–
Engineering Electronics	357	1	–	2	–
Engineering Law	314	1	–	–	–
Illumination	93, 94	1	$1\frac{1}{2}$	1	$1\frac{1}{2}$
Industrial Management	318	1	–	1	–
Modern Political and Economic Trends	325	1	–	1	–
Philosophy of Science	326	1	–	$\frac{1}{2}$	–
Practical Experience	695	–	–	–	–
Profession of Engineering	327	–	–	$\frac{1}{2}$	–
Seminar	359	–	3	–	3
Thesis	735	–	–	–	–

METALLURGICAL ENGINEERING

(COURSES 8-8a)

Two separate courses are offered, designated 8 and 8a. Course 8 deals with the production of metals from ores, and the treatment and working of metals. Course 8a deals with the ceramic and industrial mineral field.

Course 8 is planned for those who intend to pursue engineering work in the production of metals from ores, the refining of metals, the manufacture and frabrication of alloys, and the heat treatment of ferrous and non-ferrous alloys.

Courses in production metallurgy cover the theory and practice of winning aluminium, copper, iron, lead, magnesium, nickel, zinc, etc. from their ores. Physical metallurgy courses cover the production, microscopic and physical examination of alloys.

Course 8a offers a training for those who intend to work as engineers in the ceramic and industrial mineral industries. Ceramics deals with the preparation of raw materials for, and the manufacture and use of, such products as refractories, cement, heavy clay products, porcelain, pottery, glass and enamelled iron. Industrial mineral engineering includes the beneficiation and commercial utilization of minerals, not primarily used for the production of metals. Such minerals include asbestos, clay, diatomite, feldspar, gypsum, limestone, mica, quartz, talc, etc.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, e.g., Analytical Geometry 492, page 127.

GRADUATE STUDY

Graduates of this University, or of another university of comparable standing, who have taken the above course, or one similar, with a sufficiently good standing, may proceed with work leading to a graduate degree. A part of the time will be devoted to subjects chosen from physics, chemistry, and metallurgy, while the remainder will be devoted to research in physical or chemical metallurgy.

Further information appears on page 196. The Calendar of the School of Graduate Studies should be consulted for further details.

First Year Subjects Course 8	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry	492	1	–	2	–
Calculus	490	2	–	2	–
Chemistry	221, 222	2	6	2	6
Descriptive Geometry	270	1	–	1	–
Dynamics	21	1	–	2	–
Electricity	330	2	–	2	–
Engineering and Society	322	1	–	1	–
Engineering Problems and Drawing	282	–	8	–	7
English	610	1	–	1	–
Mechanical and Thermal Measurements	448	–	–	2	–
Mineralogy, Introductory	581	–	–	1	1
Physical Training	640	–	2	–	2
Statics	20	1	–	2	–
Surveying	710, 712	1	3	–	–

Second Year Subjects Course 8	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Alternating Currents	331,350	1	–	1	3
Analytical Chemistry Laboratory	228	–	9	–	9
Calculus	491	2	–	2	–
Economics	311	2	–	2	–
Electricity	332, 334	2	3	–	–
Elementary Machine Design	462	–	–	2	–
Engineering Problems and Drawing	289	–	3	–	3
Fuels and Combustion	531	1	–	1	–
Heat Engines, Elementary	420	1	–	–	–
Hydraulics, Elementary	447	1	–	–	–
Inorganic Chemistry	223	1	–	1	–
Mechanics of Materials	23	2	–	2	–
Metallurgy	530	1	–	–	–
Mining	168	1	–	1	–
Physical Chemistry	236	2	–	2	–
Physical Training	640	–	2	–	2

THIRD YEAR SUBJECTS COURSE 8	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Chemistry	225, 237	1	3	1	–
Assaying	160, 161	1	3	–	3
Business	310	–	–	1	–
Electrical Machinery	348	2	–	–	–
Electrochemistry	246, 247	$1\frac{1}{2}$	3	–	–
Elementary Structural Engineering	29	1	–	1	–
Engineering Problems and Drawing	296	–	–	–	3
Heat Engine Practice	430	1	–	1	–
Heat Engines, Theory	427, 428	1	–	1	$1\frac{1}{2}$
Metallography Laboratory	537	–	3	–	3
Metallurgy	534, 535	2	6	1	3
Modern World History	324	1	–	1	–
Ore Dressing	175, 176	–	–	2	6
Physical Metallurgy	536	2	–	2	–
Political Science	323	1	–	1	–
Principles of Ore Dressing	181	2	–	–	–

FOURTH YEAR SUBJECTS COURSE 8	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Assaying	162, 163	–	–	1	3
Electrochemistry	255, 256	1	–	1	3
Engineering Economics	313	–	–	1	–
Machine Design	469, 470	1	–	1	3
Metallography Laboratory	544	–	3	–	3
Metallurgical Theory	550	1	–	1	–
Metallurgy	541, 542	1	6	1	2
Metallurgy Problems	540	2	–	2	–
Modern Political and Economic Trends	325	1	–	1	–
Ore Dressing	177, 178	1	6	1	–
Philosophy of Science	326	1	–	$\frac{1}{2}$	–
Physical Metallurgy	543, 545	2	3	2	–
Plant Management	317	–	–	1	–
Profession of Engineering	327	–	–	$\frac{1}{2}$	–
Thesis	736	–	2	–	7

First Year Subjects Course 8a	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry	492	1	–	2	–
Calculus	490	2	–	2	–
Chemistry	221, 222	2	9	2	6
Descriptive Geometry	270	1	–	1	–
Dynamics	21	1	–	2	–
Electricity	330	2	–	2	–
Engineering and Society	322	1	–	1	–
Engineering Problems and Drawing	283	–	5	–	7
English	610	1	–	1	–
Mechanical and Termal Measurements	448	–	–	2	–
Mineralogy, Introductory	581	–	–	1	1
Physical Training	640	–	2	–	2
Statics	20	1	–	2	–
Surveying	710, 712	1	3	–	–

Second Year Subjects Course 8a	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Chemical Laboratory	228	–	12	–	11
Economics	311	2	–	2	–
Elementary Machine Design	462	–	–	2	–
Electricity	332, 334	2	3	–	–
Engineering Problems and Drawing	290	–	5	–	6
Fuels and Combustion	531	1	–	1	–
Hydraulics, Elementary	447	1	–	–	–
Industrial Chemistry	231	1	–	2	–
Inorganic Chemistry	223	1	–	1	–
Mechanics of Materials	23	2	–	2	–
Organic Chemistry	250	1	–	1	–
Physical Chemistry	236	2	–	2	–
Physical Training	640	–	2	–	2

THIRD YEAR SUBJECTS COURSE 8a	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Alternating Currents	340, 349	2	3	–	–
Assaying Laboratory	164	–	1½	–	–
Business	310	–	–	1	–
Ceramics	562	–	–	2	–
Ceramics Laboratory	564	–	6½	–	7
Chemical Engineering	242	2	–	–	–
Chemical Theory	240	1	–	1	–
Elementary Structural Engineering	29	1	–	1	–
Engineering Problems and Drawing	297	–	3	–	3
Heat Engines, Theory	421, 428	2	–	2	1½
Modern World History	324	1	–	1	–
Non-Metallic Minerals	560, 561	4	6	2	8½
Optical Mineralogy, Elementary	597	–	–	1	–
Physical Metallurgy	533	–	–	2	–
Political Science	323	1	–	1	–

FOURTH YEAR SUBJECTS COURSE 8a	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Ceramic Calculations	563	1	–	–	–
Economic Geology	402	–	–	2	–
Glass and Enamels	566	1	–	1	–
Hydraulics	440	2	3	–	–
Industrial Management	318	1	–	1	–
Industrial Minerals Laboratory	568	–	9	–	6
Machine Design	469, 470	1	–	1	3
Modern Political and Economic Trends	325	1	–	1	–
Optical Mineralogy, Advanced, Laboratory	592	–	2	–	2
Ore Dressing Laboratory	180	–	3	–	3
Philosophy of Science	326	1	–	½	–
Plant Design	300	–	–	–	3
Principles of Ore Dressing	181	2	–	–	–
Profession of Engineering	327	–	–	½	–
Refractories and Ceramic Bodies	565	1	–	2	–
Silicate Chemistry	257	2	–	–	–
Thesis	737	–	3	–	6

MINING GEOLOGY

(COURSE 9)

The course in Mining Geology is designed to train more particularly those who wish to enter the field of applied geology, but it is sufficiently broad to provide training for work in any branch of geology, unless it be that in which an extensive knowledge of palaeontology is necessary.

The economic geologist is frequently brought into contact with engineering problems and it is essential that he receive a good grounding in those subjects, such as mathematics, mechanics, chemistry, physical sciences, surveying, and engineering drawing, that constitute the preliminary work in engineering courses. It is necessary that he understand something of the language and methods of the mining, metallurgical, and construction engineer with whom he must co-operate in his work around mines, dams, and other engineering works. The first two years of this course are the same as those in Mining Engineering, since that course provides the essential preliminary work, and some mining and metallurgy are taken in the other years to broaden the knowledge of the geologist in the work of those with whom he must co-operate.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Analytical Geometry, 492, page 127.

PRACTICAL EXPERIENCE

Before receiving the degree every student in Mining Geology, is required to submit satisfactory evidence of having had six months' practical experience. (See subject 696.)

GRADUATE STUDY

Graduates in the above course, or in a similar one in any university with standards comparable to this University, with a sufficiently good standing, may proceed with work leading to a higher degree.

Work for such degree will include the preparation of a thesis on an approved subject, together with the study of such subjects as advanced structural geology, economic geology, mining, metamorphism, and geophysics.

Further information appears on page 196. The Calendar of the School of Graduate Studies should be consulted for details.

FIRST YEAR SUBJECTS COURSE 9	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry	492	1	–	2	–
Calculus	490	2	–	2	–
Chemistry	221, 222	2	6	2	6
Descriptive Geometry	270	1	–	1	–
Dynamics	21	1	–	2	–
Electricity	330	2	–	2	–
Engineering and Society	322	1	–	1	–
Engineering Problems and Drawing	276	–	6	–	6
English	610	1	–	1	–
Mechanical and Thermal Measurements	448	–	–	2	–
Mineralogy, Elementary	580, 583	–	–	2	–
Mining Laboratory	165	–	2	–	–
Physical Training	640	–	2	–	2
Practical Experience	696	–	–	–	–
Statics	20	1	–	2	–
Surveying	710, 712	1	3	–	–

SECOND YEAR SUBJECTS COURSE 9	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Chemistry Laboratory	227	–	–	–	3
Alternating Currents	331, 350	1	–	1	3
Blowpipe Analysis	589	–	–	–	2
Chemistry	224	1	–	1	–
Descriptive Geometry	272	2	–	–	–
Economics	311	2	–	2	–
Engineering Problems and Drawing	285	–	8	–	8
General Geology	388, 389	2	–	1	2
Heat Engines, Elementary	420	1	–	–	–
Mechanics of Materials	23,31	2	–	2	3

SECOND YEAR SUBJECTS COURSE 9—*Continued*	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Mining	167	1	–	–	–
Optical Mineralogy, Elementary	597	–	–	1	–
Petrography, Elementary	587	1	–	–	1
Physical Training	640	–	2	–	2
Practical Experience	696	–	–	–	–
Problems and Seminar	186	–	2	–	–
Surveying	715, 716	1	6	1	–
Theory of Measurements	182	1	–	–	–

THIRD YEAR SUBJECTS COURSE 9	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Chemistry	225, 237	1	3	1	3
Assaying	160, 161	1	3	–	3
Business	310	–	–	1	–
Economic Geology	398, 400	1	3	3	3
Geological Field Work	380	–	–	–	–
Historical Geology	383, 384	2	2	2	2
Metallurgy	530	1	–	–	–
Mining	170	1	–	1	–
Modern World History	324	1	–	1	–
Petrography, Advanced	590, 591	1	2	1	2
Physical Chemistry	236	2	–	2	–
Physical Metallurgy	546, 549	–	–	1	1
Political Science	323	1	–	1	–
Practical Experience	696	–	–	–	–
Precambrian and Economic Geology Laboratory	397	–	–	–	2
Principles of Ore Dressing	181	2	–	–	–
Structural Geology	390, 391	2	3	–	3
Survey Camp	720	–	–	–	–

FOURTH YEAR SUBJECTS COURSE 9	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Engineering Economics......	313	–	–	1	–
Geology of Canada..........	403, 404	2	–	1	2
Geology, Mining............	393, 394	2	3	1	3
Geology, Pleistocene and Physiographic...........	381, 382	1	1	1	–
Geology, Precambrian.......	392	2	–	–	–
Geophysics.................	670, 671	2	6	2	6
Mine Management..........	172	2	–	–	–
Mineralography, Laboratory..	593	–	2	–	2
Mining....................	166, 171	–	–	2	3
Modern Political and Economic Trends........	325	1	–	1	–
Optical Mineralogy, Advanced, Laboratory.......	592	–	2	–	2
Practical Experience.........	696	–	–	–	–
Profession of Engineering.....	327	–	–	$\frac{1}{2}$	–
Philosophy of Science........	326	1	–	$\frac{1}{2}$	–
Silicate Chemistry..........	257	2	–	–	–
Thesis.....................	738	–	4	–	6

AERONAUTICAL ENGINEERING

(COURSE 10)

Admission to and promotion in this course is granted only to students who meet the special requirements set forth on pages 18 and 147 of this Calendar.

The course is designed to provide a sound training in mathematics and science in the First and Second Years, together with certain fundamental subjects pertaining to the practice of aeronautical engineering. In the Third and Fourth Years, training is provided in those subjects now generally recognized as belonging strictly to the design, construction, and operation of aircraft.

The training in this course is planned to fit graduates to enter the technical design staffs of aircraft manufacturing companies. In Canada and Great Britain, due to the necessary emphasis on mass production for war purposes, there is a shortage of personnel trained to enter design staffs. In both these countries there will be opportunities for graduates in Aeronautical Engineering when wartime mass production gives way to design for peacetime transportation aircraft.

Students desiring to enter the Third Year of this course must have had at least two hours of instructional flying. Ample facilities for obtaining this instructional flying are available in peacetime. (During any period when civilian flying training is discontinued by Government action, this requirement will not be enforced.)

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Algebra and Calculus, 502, page 127.

GRADUATE STUDY

Graduates of this University, or of other Universities of comparable standing, who have taken the above mentioned or similar course with sufficiently high records may proceed with work leading to a graduate degree.

The time devoted to graduate study is divided between work on the subjects of mathematics, aerodynamics, and related subjects to the approved field of investigation chosen by the candidate.

Further information appears on page 196. The Calendar of the School of Graduate Studies should be consulted for details.

First Year Subjects Course 10	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Algebra and Calculus........	502	3½	–	3½	–
Analytical Geometry........	503	1½	–	1½	–
Applied Mechanics..........	24	2	–	2	–
Chemistry.................	221, 222	2	3	2	3
Descriptive Geometry.......	270	1	–	1	–
Electricity.................	330	2	–	2	–
Engineering and Society......	322	1	–	1	–
Engineering Problems and Drawing................	279	–	3	–	6
English....................	610	1	–	1	–
Physical Training...........	640	–	2	–	2
Properties of Matter; Mechanics and Heat	650, 651	4	3	4	3
Surveying..................	710, 712	1	3	–	–

Second Year Subjects Course 10	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Aeronautics................	11	–	–	½	–
Analytical Geometry of Space.	506	1	–	1	–
Applied Physics.............	75, 76	1	3	1	3
Descriptive Geometry.......	272	2	–	–	–
Differential Calculus.........	504	3	–	3	–
Dynamics..................	22	1	–	1	–
Economics.................	311	2	–	2	–
Engineering Problems and Drawing................	286	–	6	–	6
Heat......................	658, 659	1	3	–	–
Heat Engines, Elementary....	420	–	–	2	–
Integral Calculus and Differential Equations....	505	3	–	3	–
Mechanics of Materials......	23, 31	2	–	2	3
Physical Training...........	640	–	2	–	2
Theory of Machines I........	465	2	–	2	–

THIRD YEAR SUBJECTS COURSE 10	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Advanced Engineering Mechanics	27	1	–	1	–
Aeronautics	1	1	–	1	–
Aircraft Layout	12	–	–	–	3
Aircraft Structural Analysis	9, 10	1	3	1	3
Alternating Currents	340	2	–	–	–
Applied Elasticity	33	1	–	1	–
Differential Equations	507	1	1	1	1
Direct Current Machines	338	–	–	2	–
Elementary Structural Engineering	29	1	–	1	–
Heat Engines, Theory	421, 423	2	3	2	3
Hydrodynamics	662	1	–	1	–
Machine Design	467, 468	2	6	2	6
Modern World History	324	1	–	1	–
Political Science	323	1	–	1	–
Theory of Functions	508	1	1	1	1

FOURTH YEAR SUBJECTS COURSE 10	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Aerodynamics	3, 4	2	6	2	6
Aircraft Components	2	1	–	1	–
Aircraft Electricity	366	–	–	1	–
Aircraft Hydraulics	452	1	–	–	–
Aircraft Materials	551	1	–	1	–
Airplane Design and Layout	5, 6	2	9	2	9
Airplane Stress Analysis	7, 8	2	3	2	3
Internal Combustion and Aircraft Engines	425	1	–	1	–
Modern Political and Economic Trends	325	1	–	1	–
Philosophy of Science	326	1	–	$\frac{1}{2}$	–
Profession of Engineering	327	–	–	$\frac{1}{2}$	–
Theoretical Hydrodynamics	523	1	–	1	–
Theory of Elasticity	522	2	–	–	–
Thesis	739	–	–	–	–

ENGINEERING AND BUSINESS

(COURSE 11)

A substantial proportion of those who are admitted to the Faculty of Applied Science and Engineering have no particular interest in any one branch of technology, but desire a broad general training, preponderately engineering in character, that will fit them rather for executive or administrative positions, than for those of a purely technical or design nature. Many engineers nowadays occupy positions of responsibility in sales, production, purchasing, and other similar branches of industry, and for those who wish to enter such fields, the training offered should contain a greater proportion of economic, business, and management instruction than is possible in the distinctively technical courses.

The course in Engineering and Business is designed to cover that field and to be suitable for those who require such training. It is not expected that graduates from this course will immediately enter upon executive work; indeed, their early work may be almost entirely of a technical character, but it is anticipated that their ultimate tendency will be toward positions in the field of management or business. Their progress in that direction will depend largely on their own industry and abilities. Moreover, all engineers, whatever their duties may be, must be able to handle men as well as machines and their duties tend to become more and more administrative in character as they assume positions of increasing responsibility.

The subjects of instruction are shown in the following tables. In these tables, reference numbers have been assigned to the subjects referring to a more detailed description of each, e.g., Analytical Geometry, 492, page 127.

Before receiving the degree, every student in Engineering and Business is required to submit satisfactory evidence that he has had practical experience satisfactory to the Committee administering the course.

Successful completion of the First Year of any course in the Faculty, except Architecture, will entitle a student to apply to enter the course in Engineering and Business, which commences with the Second Year.

For the Session 1945-46 the Second Year only of the curriculum set out below will be offered.

Students desiring to enter the Second Year of the course are required to submit applications to do so to the Secretary of the Faculty not later than September 15th.

SECOND YEAR SUBJECTS COURSE 11	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Applied Physics	70, 71	1	3	1	3
Calculus	491	2	–	2	–
Descriptive Geometry	272	2	–	–	–
Direct Current Machines	338	–	–	2	3
Dynamics	22	1	–	1	–
Economics	311	2	–	2	–
Electricity	332, 334	2	3	–	–
Engineering Chemistry	239	2	–	2	–
Engineering Problems and Drawing	286	–	6	–	8
Heat Engines, Elementary	420	–	–	2	–
Hydraulics, Elementary	447	1	–	–	–
Mechanics of Materials	23, 31	2	3	2	–
Physical Metallurgy	533	–	–	2	–
Physical Training	640	–	2	–	2
Practical Experience	698	–	–	–	–
Public Speaking	320	–	–	–	1

THIRD YEAR SUBJECTS COURSE 11	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Accounting and Statistics	307	3	2	3	2
Alternating Currents	340, 346	2	3	–	–
Applied Economics	308	2	–	2	2
Elementary Structural Engineering	29	1	–	1	–
Engineering Problems and Drawing	302	–	6	–	3
Heat Engines, Theory	421, 423	2	–	2	3
Hydraulics	440, 441	2	–	2	3
Industrial Management I	328	1	2	2	1
Machine Design	467, 468	2	3	2	3
Modern World History	324	1	–	1	–
Political Science	323	1	–	1	–
Practical Experience	698	–	–	–	–

FOURTH YEAR SUBJECTS COURSE 11	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Alternating Current Machinery	345, 346	–	–	2	3
Business Policy	309	2	3	3	4
Engineering Economics	313	–	–	1	–
Engineering Law	314	1	–	–	–
Heat Treatment of Iron and Steel	547, 548	1	–	1	1½
Illumination	93, 94	1	1½	1	1½
Industrial Management II	329	3	3	3	3
Manufacturing Processes	476, 477	2	3	2	3
Modern Political and Economic Trends	325	1	–	1	–
Philosophy of Science	326	1	–	½	–
Practical Experience	698	–	–	–	–
Profession of Engineering	327	–	–	½	–
Structural Engineering	46, 299	2	3	–	–
Thesis	740	–	2	–	2

OUTLINE OF LECTURE AND LABORATORY SUBJECTS

On the pages that follow a brief description is given of the lectures and laboratory subjects prescribed in the preceding tables of curriculum. The numbers before the subjects are the reference numbers assigned in the tables. For example, 20. Statics, means the course of lectures indicated by this number in the table of curriculum for the First Year on page 28.

AERONAUTICAL ENGINEERING

1. Aeronautics. T. R. Loudon.

Course 10, III Year; 1 hr. lecture per week, both terms.

An introductory course on the basic principles of aerodynamics and theory of flight. The elements of stability and control are discussed and the fundamental theory of performance estimation is outlined in these lectures.

Text books: Technical Aerodynamics—K. D. Wood. Aerodynamics of the Airplane—Millikan.

2. Aircraft Components. T. R. Loudon and selected lecturers.

Course 10, IV Year; 1 hr. lecture per week, both terms.

The lectures are given by members of the University staff, together with selected design engineers from operating commercial organizations.

3. Aerodynamics. B. Etkin.

Course 10, IV Year; 2 hrs. lectures per week, both terms.

An advanced course in aerodynamics as applied to the design of aircraft. Such topics as load grading curves, static and dynamic stability, control and manœuverability, propeller theory and performance estimation are discussed.

Text books: Aerofoil and Airscrew Theory—Glauert. Aerodynamics — Piercy. Aircraft Propeller Design — Weick. Aerodynamics of the Airplane—Millikan.

4. Aerodynamics Laboratory. B. Etkin.

Course 10, IV Year; 6 hrs. laboratory per week, both terms.

This subject is intended to amplify the lecture course on hydrodynamics and aerodynamics. The calibration and practical use of wind tunnel instruments are explained, and experiments are carried out to illustrate the points discussed in the lectures.

5. Airplane Design and Layout. T. R. Loudon and selected lecturers.

Course 10, IV Year; 2 hrs. lectures per week, both terms.

Methods of application of aerodynamic theory and stress analysis to the design of airplanes are discussed. Problems are set for the laboratory periods in which actual airplane layouts are made and stressed for the required conditions in practice.

Text books: Air Ministry Publications 970 and 1208. C.A.M.-04. C.A.R.-04.

6. Airplane Design and Layout Laboratory. T. R. Loudon.

Course 10, IV Year; 9 hrs. laboratory per week, both terms.

In this subject, the principles from the various lecture subjects on aerodynamics and stress analysis are applied to the design of an aeroplane as a whole, and to its component parts. The British Air Ministry and U.S.A. conditions used in Canada are applied to these design problems.

7. Airplane Stress Analysis. T. R. Loudon.

Course 10, IV Year; 2 hrs. lectures per week, both terms.

An advanced course continuing the work of the Third Year on aircraft framed structures and stringer skin combinations. Shear flow in open and closed sections is discussed. Strain energy, the elastic centre and moment distribution methods are outlined. Simple and continuous beam columns are analyzed and various other structural problems encountered in aircraft design are taken up and problems worked out.

Text books: Airplane Structures—Niles and Newell. Airplane Structural Analysis and Design—Sechler and Dunn.

8. Airplane Stress Analysis. T. R- Loudon.

Course 10, IV Year; 3 hrs. laboratory work per week, both terms.

Problems are worked out using the theory explained in the lectures of subject 7. These problems all relate to aircraft.

9. Aircraft Structural Analysis. T. R. Loudon.

Course 10, III Year; 1 hr. lecture per week, both terms.

Elementary principles of advanced structural analysis used in aircraft design. Problems are set to be worked out in the laboratory.

Text books: Airplane Structures—Niles and Newell. Airplane Structural Analysis and Design—Sechler and Dunn.

10. Aircraft Structural Analysis Laboratory. T. R. Loudon, B. Etkin.

Course 10, III Year; 3 hrs. laboratory per week, both terms.

Problems based upon the lectures in subject 9 are worked out during these periods.

11. Aeronautics. T. R. Loudon.

Course 10, II Year; 6 lectures, second term.

An introductory course to the work of III Year Aeronautics (1).

12. Aircraft Layout. Selected lecturers.

Course 10, III Year; 3 hrs. laboratory per week, second term.

Methods of layout and detailing peculiar to the aircraft industry.

APPLIED MECHANICS AND DESIGN OF STRUCTURES

20. Statics. T. R. Loudon.

Courses 1, 2, 3, 4, 6, 7, 8, 8a, and 9, I Year; 1 hr. lecture per week, first term; 2 hrs. lectures per week, second term.

Fundamental principles of the laws of equilibrium of forces are discussed. These principles are applied to the determination of stresses in simple structures. Toward the end of the subject an introduction to Mechanics of Materials is given.

Text book: Engineering Mechanics-Statics—Timoshenko and Young.

21. Dynamics. M. W. Huggins, B. Etkin.

Courses 1, 2, 3, 6, 7, 8, 8a, and 9, I Year; 1 hr. lecture per week, first term; 2 hrs. lectures per week, second term.

A subject designed to extend the elementary principles of preparatory school mechanics to a more general viewpoint. Under the heading of kinematics, the general equations of motion, both linear and angular, are developed.

Centres of mass and moments of inertia are calculated.

The principles of linear and angular momentum are dealt with and a fairly comprehensive course on effective and inertia forces as applied to engineering problems is given. The discussion of energy, work, and power is extended as far as possible to practical problems.

Simple harmonic motion is also discussed.

Text books: Analytical Mechanics for Engineers—Seely and Ensign. Introduction to Mechanics—J. W. Campbell.

22. Dynamics. I. W. Smith.

Courses 1, 3, 5, 7, 10, and 11, II Year; 1 hr. lecture per week, both terms.

This subject extends the work of the First Year to more general applications, such as: bodies moving with general plane motion, compound pendulum, gyroscopic action.

Text books: Analytical Mechanics for Engineers—Seely and Ensign.

23. Mechanics of Materials, R. F. Legget, M. W. Huggins.

All courses, II Year; 2 hrs. lectures per week, both terms.

In this subject, the fundamental theories of stress and strain are discussed and applied in the design of tension members, riveted joints, pipes and tanks, beams, columns, shafts, etc. A number of problems are worked out both in the lecture course and in the drafting room.

Text books: Resistance of Materials—Seely. Strength of Materials—Morley. Mechanics—Sears.

24. Applied Mechanics. B. Etkin.

Courses 5 and 10, I Year; 2 hrs. lectures per week, both terms.

This subject is divided into two parts: one dealing with the application of the principles of statics to elementary framed structures and simple beams, and the other dealing with the fundamental principles of dynamics of a particle extended eventually to consideration of rigid bodies.

Text book: Engineering Mechanics—Timoshenko and Young. (2 vols.)

27. Advanced Engineering Mechanics. B. Etkin.

Course 10, III Year; 1 hr. lecture per week, both terms.

Advanced statics; theory of elastic bodies; dimensional analysis and model testing; and a statement of the principles of dynamics, with applications to a variety of problems, including vibration and rotation.

28. Elementary Structural Engineering. C. F. Morrison.

Course 1, III Year; 2 hrs. lectures per week, both terms.

An elementary study of the stress analysis and design of structures, structural members, and their details. Problems in analysis and design are worked out in the lectures and in the drafting room.

The work in the first term includes a discussion of tension members, steel and timber columns, simple and continuous beams, box girders, and plate girders. Welding as a method of connecting structural steel members is studied.

The second term is given chiefly to moving loads, the design of a riveted truss highway span, and the theory of railway truss spans.

Text books: Theory of Simple Structures—Shedd and Vawter. Structural Problems—Young. Steel Construction Handbook—A.I.S.C.

29. Elementary Structural Engineering. M. W. Huggins, W. H. M. Laughlin.

Courses 2, 3, 5r, 8, 8a, 10, and 11, III Year; 1 hr. lecture per week, both terms.

Practically the same work as that for subject 28 in the first term.

30. Structural Design, C. F. Morrison.

Course 4, III Year; 2 hrs. lectures and 3 hrs. problems per week, both terms.

The stress analysis and design of elementary structures and structural members of timber, steel and reinforced concrete are studied in this subject. Practical problems on the design of beams, columns, piers, footings, and roof trusses are worked out in the drafting room. Some time is spent testing and determining the physical properties of structural materials.

Reference books: Architectural Construction—Gay and Parker. Design of Steel Buildings—Hauf. Elementary Structural Engineering—Urquhart and O'Rourke.

31. Mechanics of Materials: General. T. R. Loudon, W. L. Sagar, C. E. Helwig.

Courses 1, 2, 5, 9 and 10, II Year; 3 hrs. laboratory per week, second term.

Courses 3, 7, and 10, II Year; 3 hrs. laboratory per week, first term.

An introduction to the experimental study of the strength and elasticity of engineering materials. In it he should acquire a first hand knowledge of the properties of certain common materials of construction, and some familiarity with the manner in which they might be expected to behave when subjected to loads.

Reference book: Junior Laboratory Course in Mechanics of Materials, Department of Civil Engineering; Municipal and Structural.

33. Applied Elasticity. M. W. Huggins.

Courses 1 and 10, III Year; 1 hr. lecture per week, both terms.

A study of the stresses and strains in structural materials and members. The topics treated include: members subjected to direct stress, shear stress, and flexural stress, and their resulting deformations; principal stresses; statically indeterminate structures such as continuous and fixed-end beams; the moment-area theorems; photo-elasticity as a method of determining stress intensity.

Reference books: Elements of Strength of Materials—Timoshenko and MacCullough. Applied Elasticity—Timoshenko and Lessels.

34. Applied Elasticity. M. W. Huggins.

Course 1a, IV Year; 1 hr. lecture per week, both terms; 3 hrs. problems per week, first term; 2 hrs. problems per week, second term.

A study of deformations and stresses in the following: beams on elastic foundations; concrete water tanks; heads of steel tanks; streets, both uniform and tapered subject to axial and side loads; curved beams. Problems based on the work covered in the lectures are worked out in the computing period by analytical, photo-elastic, and Begg's deformeter method.

Reference books: Strength of Materials, Vols. I and II—Timoshenko.

35. Cements and Concrete. W. L. Sagar, C. E. Helwig.

Course 1, III Year; 1 hr. lecture per week, both terms.

The work in the first term includes a discussion of the cements used in construction, Portland cement in particular, and a study of the basic principles of concrete making.

In the second term the elements of the theory of reinforced concrete are discussed and examples are considered in the design of slabs, beams, and columns.

Text books: Plain Concrete—Bauer. Chemistry of Cement and Concrete—Lea and Desch. Reinforced Concrete Design—Sutherland and Clifford. Reinforced Concrete Construction, Vol. I—Hool. Elementary Structural Engineering—Urquhart and O'Rourke.

36. Theory of Structures. C. F. Morrison.

Course 1, IV Year; 1 hr. lecture per week, both terms.

The stress analysis of simple span, continuous, and cantilever trusses. Influence lines and index stresses. Truss deflections by analytical and graphical methods. Arches, suspension bridges, and statically indeterminate structures.

Text books: Theory of Simple Structures—Shedd and Vawter. Theory of Modern Steel Structures, Vol. II—Grinter.

37. Advanced Structural Analysis. M. W. Huggins, C. F. Morrison.

Course 1a, IV Year; 1 hr. lecture, 2 hrs. problems per week, both terms.

The analysis of statically indeterminate structural problems, with particular reference to the following: flexural deflections by single and double integration, by moment areas, shear areas, elastic weights, dummy loads, and Castigliano's first theorem; the slope-deflection method; the moment-distribution method; the method of least work and the column analogy.

Reference book: Theory of Modern Steel Structures, Vol. II—Grinter.

38. Mechanics of Materials: General. T. R. Loudon, W. L. Sagar, C. E. Helwig.

Course 1, IV Year; 3 hrs. laboratory per week, both terms.

Practice in investigating the elastic and physical properties of iron, steel, concrete, timber, etc., and the use of instruments of precision designed for this purpose.

Reference book: Materials of Construction—Johnson.

39. Foundations and Retaining Walls. R. F. Legget.

Courses 1 and 4, IV Year; 1 hr. lecture per week, both terms.

A study of the necessity for accurate knowledge of sub-surface conditions as a preliminary to all foundation, retaining wall and

dam design serves to introduce this course which deals with methods of sub-surface exploration, and the elements of the design of foundation units, bridge piers, and retaining walls of concrete and of steel. Attention is paid to relevant constructional requirements.

40. Soil Mechanics. W. L. Sagar, R. F. Legget.

Course 1, IV Year; 1 hr. lecture per week, first term.

A subject devoted to those physical and mechanical properties of soils of importance to the engineer, such as compressive and cohesive strengths, internal friction, stability in slopes, compressibility and other deformational characteristics, permeability and moisture retention. The bearing of these properties on the design and construction of engineering works is considered in detail.

Reference books: Engineering Properties of Soil—Hogentogler. Notes on Soil Mechanics and Foundations—Plummer.

41. Reinforced Concrete. C. F. Morrison.

Course 1, IV Year; 1 hr. lecture per week, both terms.

The theory of the strength of reinforced concrete elements, including the beam, the slab, the T-beam, the column, and the girderless floor, is continued in this subject.

The analysis of the monolithic arch by the elastic theory is discussed, and the student is required in the drafting room to apply his knowledge to the design of simple structures.

Reference books: Design of Concrete Structures—Urquhart and O'Rourke. Reinforced Concrete Design—Sutherland and Reese.

42. Structural Design. C. F. Morrison.

Course 4, IV Year; 1 hr. lecture and 3 hrs. problems per week, both terms.

The study of the analysis and design of structural members and structures is continued in this subject. The lectures are supplemented by problems assigned in the drafting room. These problems include the preparation of drawings showing the structural framing and details for various buildings.

43. Structural Design. C. F. Morrison, W. H. M. Laughlin.

Course 1, IV Year; 2 hrs. lectures per week, first term; 1 hr. lecture per week, second term.

Consideration is given to the various types of industrial buildings and other structures, the conditions governing their choice, and the design and details of construction in different materials. Examples in design are worked out in the class and drafting rooms illustrating such points as: economic arrangement of building frames, probable loadings for girders and columns, column eccentricities, wind loading, wind bracing, rigid frames, crane runways, cableways, headframes, tanks and towers.

Reference books: Handbook of Building Construction—Hool and Johnson. Architects' and Builders' Handbook—Kidder-Parker. Steel Mill Buildings—Ketchum.

44. Mechanics of Materials: Concrete. T. R. Loudon, W. L. Sagar, C. E. Helwig.

Course 1, III Year; 2 hrs. laboratory per week, first term.

Fundamentals in the design of sound concrete, including acceptability tests on the materials used in making concrete, experiments to show the effect on the consistency and strength of the concrete caused by variations in the quantities of the ingredients, and the design of an economical mix for a given set of conditions.

Reference books: Design and Control of Concrete Mixtures—Portland Cement Association. Materials Testing—Gilkey, Murphy, Bergman.

46. Structural Engineering. C. F. Morrison.

Courses 3 and 11, IV Year; 2 hrs. lectures per week, first term.

A study is made of various types of industrial buildings and other structures. Methods of analysis and examples in design are considered, involving the use of timber, structural steel, and reinforced concrete.

Reference books: Elementary Structural Engineering—Urquhart and O'Rourke. Steel Mill Buildings—Ketchum. Handbook of building Construction—Hool and Johnson.

47. Structural Design. C. F. Morrison.

Course 4, V Year; 1 hr. lecture and 3 hrs. problems per week, both terms.

In this subject some of the more advanced work in reinforced concrete is studied, including flat slab construction, panels reinforced in two directions, rigid frames and arches. In the drafting room the students apply the principles of structural design to problems in which actual buildings are designed and detailed.

50. Mechanics of Materials: Soils and Highway. W. L. Sagar, R. F. Legget, C. E. Helwig.

Course 1, IV Year; 3 hrs. laboratory per week, second term.

Experiments relating to the physical properties of rocks such as are used in road building, and bituminous materials as used in road and airport construction. Physical and mechanical characteristics of soils, related to highway and foundation work, are investigated in a series of experiments that provide an introduction to practical Soil Mechanics.

Reference books: Construction of Roads and Pavements—Agg. Specifications—Dept. of Highways, Ontario. Soil Mechanics—Krynine.

APPLIED PHYSICS

70. Applied Physics. V. L. Henderson.

Courses 7 and 11, II Year; 1 hr. lecture per week, both terms.

Correlating the physical principles of light, heat, sound, and vibration with problems in engineering, emphasizing the importance of the analytical approach.

Reference books: Fundamental Principles of Physics—Heil and Bennett. Introduction to Physical Optics—Robertson.

71. Applied Physics Laboratory. V. L. Henderson.

Courses 7 and 11, II Year; 3 hrs. laboratory per week, both terms.

Supplementing subject 70.

72. Optics. K. B. Jackson.

Course 6, III Year; 1 hr. lecture per week, both terms.

Light, geometrical and physical optics, and optical instruments pertaining to chemical engineering.

Text books: Optical Methods of Chemical Analysis—Gibb. Elements of Optics—Valasek.

73. Optics Laboratory. K. B. Jackson.

Course 6, III Year; 3 hrs. laboratory per week, second term.

Supplementing subject 72.

75. Applied Physics. E. L. Dodington.

Courses 1 and 10, II Year; 1 hr. lecture per week, both terms.

Correlating the physical principles of light, heat, sound and vibration with problems in engineering, emphasizing the importance of the analytical approach.

Reference book: Handbook of Engineering Fundamentals—Eshbach.

76. Applied Physics Laboratory. E. L. Dodington.

Courses 1 and 10, II Year; 3 hrs. laboratory per week, both terms.

Supplementing subject 75.

77. Photography. K. B. Jackson.

Course 4, II Year; 1 hr. lecture per week, first term.

The principles of photography, photographic equipment, materials, and processes, with special reference to architectural photography.

Reference books: Elementary Photography—Quarles. Fundamentals of Photography—Boucher.

78. Photography Laboratory. K. B. Jackson.

Course 4, II Year; 3 hr. laboratory per week, first term.

Supplementing subject 77.

79. Photometry. K. B. Jackson, E. L. Dodington.
Courses 5c, 5g, 5i, and 5s, III Year; 1 hr. lecture per week, first term.
Photometry, and the use of photography as a scientific implement.

80. Photometry. E. L. Dodington.
Courses 5c, 5s, 5g, and 5i, III Year; 3 hrs. laboratory per week, first term.
Supplementing subject 79.

81. Photographic Surveying. K. B. Jackson.
Course 1, III Year; 1 hr. lecture per week, first term.
An introduction to the methods and applications of terrestrial and aerial photographic surveying.

82. Photographic Surveying. K. B. Jackson.
Course 1b, IV Year; 2 hrs. lectures per week, first term.
Photogrammetric optics, surveying, cameras, photographic materials and processes. Terrestrial and aerial photography. Radial plotting methods, mosaics, stereoscopic methods. Mapping from oblique photographs. Applications.

83. Photographic Surveying Laboratory. K. B. Jackson, S. H. deJong.
Course 1b, IV Year; 5 hrs. laboratory per week, first term.
Supplementing subject 82.

85. Light and Acoustics. V. L. Henderson.
Course 4, III Year; 1 hr. lecture per week, both terms.
Production and propagation of sound, the control of reverberation, sound transmission through partitions, and vibration insulation; and an elementary course in the production of light, and the measurement of light and electricity, in preparation for subject 87.
Reference book: Acoustics of Buildings—Watson.

86. Light and Acoustics Laboratory. V. L. Henderson.
Course 4, III Year; 2 hrs. laboratory per week, both terms.
Supplementing subject 85.

87. Illumination Design. E. L. Dodington.
Course 4, IV Year; 1 hr. lecture per week, both terms.
Control of light distribution, the computation of illumination and brightness, and the design of lighting installations for public and private buildings.

88. Illumination Design Laboratory. E. L. Dodington.
Course 4, IV Year; 1 hr. laboratory per week, both terms.
Supplementing subject 87. By co-operation with the staff of the School of Architecture, problems in lighting design and acoustics will form a part of certain problems in architectural design in subjects 123, 124, and 125.

89. Architectural Acoustics. V. L. Henderson.

Course 5i, IV Year; 1 hr. lecture per week, first term; 3 hrs. lectures per week, second term.

Design of buildings for good acoustics, the calculation and measurement of the acoustical properties of buildings and materials, and the treatment of buildings to improve their acoustical properties and to control the nuisance of noise.

90. Architectural Acoustics Laboratory. V. L. Henderson.

Course 5i, IV Year; 3 hrs. laboratory per week, first term; 9 hrs. laboratory per week, second term.

Supplementing subject 89.

93. Illumination. V. L. Henderson.

Courses 7 and 11, IV Year; 1 hr. lecture per week, both terms.

Illuminating Engineering dealing with the production and measurement of light and colour, and the theory and design of lighting equipment and installations.

Reference books: Scientific Basis of Illuminating Engineering—Moon. Illuminating Engineering—Boast.

94. Illumination Laboratory. V. L. Henderson.

Courses 7 and 11, IV Year; 3 hrs. laboratory alternate weeks, both terms.

Supplementing subject 93.

95. Photometry and Illumination Design. K. B. Jackson, V. L. Henderson.

Course 5i, IV Year; 2 hrs. lectures per week, both terms.

Measurements of luminous intensity, luminous flux, illumination, brightness, reflection, transmission, absorption, diffusion, and colour by visual and physical methods; and on the design and application of illuminating engineering equipment.

96. Photometry and Illumination Design Laboratory. K. B. Jackson. V. L. Henderson.

Course 5i, IV Year; 6 hrs. laboratory per week, both terms.

Supplementing subject 95.

97. Acoustics. V. L. Henderson.

Courses 5c and 5s, IV Year ; 1 hr. lecture per week, first term.

Acoustics of electrical sound systems; including sound waves, hearing, the mechanical-electrical-acoustical analogy, microphones, loud speakers, etc.

Reference books: Elements of Acoustical Engineering—Olson. Applied Acoustics—Olson and Massa.

98. Acoustics. V. L. Henderson.

Course 7, IV Year; 1 hr. lecture per week, first term.

This subject deals with the properties of acoustical elements, particularly with their application in electrical sound systems.

Reference books: Elements of Acoustical Engineering—Olson. Applied Acoustics—Olson and Massa.

99. Vibration Engineering. V. L. Henderson.

Course 5r, IV Year; 1 hr. lecture per week, both terms.

Vibrating systems with one degree of freedom. Electrical analogues and impedance methods. Systems with more than one degree of freedom. Application to machines and structures. Instrumental methods.

100. Vibration Laboratory. V. L. Henderson, M. J. C. Lazier.

Course 5r, IV Year; 3 hrs. laboratory per week, both terms.

A series of experiments designed to give familiarity with the nature of vibrating systems and the causes, measurement, and control of vibration in engineering problems.

ARCHITECTURE, DRAWING, AND PAINTING

110. History of Architecture. A. P. C. Adamson.

Course 4, I Year; 1 hr. lecture per week, both terms.

Development of architecture, traced from earliest times to the close of the Byzantine Period.

Reference books: A Short Critical History of Architecture—H. Heathcote Statham. The Architecture of Ancient Greece—Anderson, Spiers, and Dinsmoor. The architecture of Ancient Rome—Anderson, Spiers, and Ashby. The Grammar of Ornament—Owen Jones.

111. History of Architecture. A. P. C. Adamson.

Course 4, II Year; 1 hr. lecture per week, both terms.

In this subject the development of architecture is traced from the Romanesque Period to the end of the Gothic Period.

Reference books: A Short Critical History of Architecture—H. Heathcote Statham. Medieval Architecture—Arthur Kingsley Porter. Gothic Architecture in England—Francis Bond. The Grammar of Ornament—Owen Jones.

112. History of Architecture A. H. H. Madill.

Course 4, III Year; 1 hr. lecture per week, first term.

In this subject the architecture of the Renaissance in Italy and France is studied with special reference to planning and composition.

Reference books: A Short Critical History of Architecture—H. Heathcote Statham. Architecture of the Renaissance in Italy—Anderson and Stratton. The Architecture of the Renaissance in France, Vols. I and II—W. H. Ward. The Renaissance of Roman Architecture—T. G. Jackson.

113. History of Architecture B. E. R. Arthur.

Course 4, III Year; 1 hr. lecture per week, both terms.

This series of lectures is divided into two parts. During the first term Renaissance architecture of England is examined along with the social history of the period. The second term includes a study of the various art movements and the engineering of the 19th century, followed by a study of the modern movement during the 20th century.

Reference books: Growth of the English House—J. Alfred Gotch. A History of Renaissance Architecture in England, Vol. 1 and 2—R. Blomfield. History of the English House—N. Lloyd. Space, Time and Architecture—S. Giedion. English Social History—G. M. Trevelyan. Modern Buildings—W. C. Behrendt.

115. Functional Requirements of Buildings.

Course 4, III Year; special lectures, both terms.

In this subject the principles underlying the planning of such buildings as churches, theatres, office buildings, etc., are discussed in detail.

116. Garden Design. H. B. Dunington Grubb.

Course 4, III, IV, and V Years; Special lectures, first term.

In this subject the historical development of Garden Design is traced from earliest times; the study of sites; the influence of topography, orientation, access, etc., on the problems of design; site planning; the location of buildings; the solution of an actual problem on a typical site.

117. Town Planning. A. P. C. Adamson, J. A. Murray.

Course 4, V Year; 1 hr. per week, second term.

The social and technical history of the town from ancient to modern times is studied. This is followed by consideration of planning organizations and offices, and general planning procedure, including basic data and studies. Plan types of residential, industrial, commercial, institutional, and recreational areas are studied. Modern plans and planning reports are investigated and the course concludes with planning as a political science.

118. Elements of Architectural Form. E. R. Arthur.

Course 4, I Year; 1 hr. lecture per week, both terms.

An introductory lecture leading to composition and planning in later years. Simple domestic plans are discussed, and elements of design are examined in relation to actual buildings. These elements include windows, doors, roofs, texture, materials, etc.

Reference books: Theory and Elements of Architecture, Vol. I, Part I—Robert Atkinson and Hope Bagenal. Current Periodicals.

119. History of Painting. P. H. Brieger.

Course 4, IV Year; 1 hr. lecture per week, both terms.

An outline of the history and development of painting and of the minor pictorial arts from the earliest time until the present day.

120. History of Sculpture. P. H. Brieger.

Course 4, III Year; 1 hr. lecture per week, first term.

History of architectural sculpture, including the modern.

121. Architectural Drawing. H. H. Madill, W. E. Carswell.

Course 4, I Year; 14 hrs. studio per week, first term; 15 hrs. studio per week, second term.

The course commences with instruction in drafting and lettering. It becomes the drafting room component of a number of subjects in the curriculum, including mathematics, applied mechanics, forms and details of elementary construction, isometric and perspective drawing. An elementary design is attempted toward the end of the year.

122. Architectural Design. H. H. Madill, E. R. Arthur, J. A. Murray.

Course 4, II Year; 15 hrs. studio per week, first term; 21 hrs. studio per week, second term.

This subject is given by means of individual instruction in the studio, and by criticism of the solutions of different problems set during the year. It is in this subject that the student begins the serious study of design; continued practice in architectural drawing and rendering affords the training necessary to make the student a more proficient draughtsman. Basic problems studied in this Year include simple residential and institutional buildings. One problem is carried through to working drawings in masonry or wood.

123. Architectural Design. H. H. Madill, E. R. Arthur, J. A. Murray.

Course 4, III Year; 15 hrs. studio per week, first term; 18 hrs. studio per week, second term.

This subject is given by individual instruction in the studio and by criticism of solutions of problems set during the year. The greater part of the subject is devoted to problems in design and forms a continuation of the subject given in the preceding year.

Basic problems studied in this Year include commercial and industrial buildings. One problem is carried through to working drawings in steel construction.

124. Architectural Design. H. H. Madill, E. R. Arthur, J. A. Murray.

Course 4, IV Year; 17 hrs. studio per week, both terms.

A continuation of the work of the preceding years, given by individual instruction in the studio and criticisms of the solution of problems set during the year. Basic problems studied in this Year include interior design and furniture, alterations, complex residential or institutional buildings. One problem is carried through to working drawings in concrete construction.

125. Architectural Design. H. H. Madill, E. R. Arthur, J. A. Murray.
Course 4, V Year; 23 hrs. studio per week, first term; 25 hrs. studio per week, second term.
More advanced problems in design are studied and a major design thesis is carried through completely from sketches to working drawings and specifications.

128. Theory of Architectural Planning. E. R. Arthur, J. A. Murray.
Course 4, II Year; 1 hr. lecture per week, both terms.
The general principles of planning of buildings from the small to complex problems. In the second term actual plans of libraries, banks, houses, etc., are studied as an aid to problems in design and a preliminary to work in the following years.
The discussions include planning methods, technical factors influencing architectural design, basic principles of massing, composition, proportion and scale.
Reference books: Elements of Form and Design in Classic Architecture—Arthur Stratton. The Modern House—F. R. S. Yorke. The Smaller English House of the Later Renaissance, 1660-1830—A. E. Richardson and H. D. Eberlein. The Plan Requirements of Modern Buildings—V. O. Rees.

130. Housing. E. R. Arthur.
Course 4, IV and V Years; 1 hr. lecture per week, first term.
This series deals with housing for sale or rent, but is concerned mainly with the lower income groups. The study includes financing, planning, site planning, and materials. The lectures are illustrated. Following the lectures a problem in design is set in the drafting room.
Reference books: Europe Rehoused—Elizabeth Denby. Modern Housing—Catherine Bauer. Report of the committee on Housing and Community Planning No. 4.

131. Freehand Drawing and Water Colour Painting. H. J. Burden, W. E. Carswell.
Course 4, I Year; 2 hours studio per week, both terms.
Drawing from still life, primary freehand perspective, primary pencil, charcoal, and pen and ink rendering.

132. Freehand Drawing, Water Colour Painting, and Rendering. W. E. Carswell.
Course 4, II Year; 2 hrs. studio per week, both terms.
Drawing and painting from still life, drawing from the cast in pencil, pen and ink, and wash rendering. Primary water colour, drawing from landscape and pictorial composition.

In addition to the periods set out above, instruction is given in the studios in rendering (wash, charcoal, and other mediums), as problems in design approach completion.

Students are required to attend a course in field sketching at the University Survey Camp during the last week in September.

Students will report at the Camp on the date shown on page 5.

133. Freehand Drawing, Water Colour Painting, and Rendering. W. E. Carswell, S. B. Barclay.

Course 4, III Year; 2 hrs. studio per week, both terms.

Drawing from the cast, water colour from still life, water colour rendering, drawing from landscape and natural objects.

Students who are sufficiently advanced are admitted to the Fourth Year Life Drawing Class.

In addition to the periods set out above, instruction is given in the studios in rendering (wash, charcoal and other mediums), as problems in design approach completion.

Students are required to attend a course in field sketching at the University Survey Camp during the last week in September.

Students will report at the Camp on the date shown on page 5.

134. Freehand Drawing, Water Colour Painting and Rendering. W. E. Carswell, S. B. Barclay.

Course 4, IV Year; 2 hrs. studio per week, both terms.

Abstract design, colour composition, and drawing from life.

In addition to the periods set out above, instruction is given in the studios in rendering (wash, charcoal, and other mediums), as problems in design approach completion.

Students are required to attend a course in field sketching at the University Survey Camp during the last week in September.

Students will report at the Camp on the date shown on page 5.

136. Colour. W. E. Carswell.

Course 4, II Year; 1 hr. lecture per week, first term.

This subject is intended to assist the student in an appreciation of the value of colour and its application to architecture. Colour in period and modern rooms, the effect of sunlight and shade on colour, and differences in treatment in domestic, civic and institutional buildings are examined in class and on the boards. Theory of colour is discussed and the student is made familiar with such modern systems as those of Ostwald and Munsell.

137. Modelling. Frederick Coates.

Course 4, II Year; 2 hrs. studio per week, both terms.

Scale models of architectural forms.

138. Modelling. Frederick Coates.

Course 4, III Year; 2 hrs. studio per week, both terms.

Scale models of simple buildings.

139. Modelling. Frederick Coates.

Course 4, IV Year; 2 hrs. studio per week, both terms.

Scale models of buildings and settings.

140. Building Construction. H. H. Madill.

Course 4, I Year; 1 hr. lecture per week, second term.

Instruction is given in elementary construction using common building materials. The detailing of doors, windows, roofs, etc.

Reference books: Architectural Building Construction, Vol. 1—Jaggard and Drury. Building Construction, Vol. I—V. F. Mitchell. Architectural Graphic Standards—Ramsey and Sleeper.

141. Building Materials: Architectural Application. H. H. Madill.

Course 4, IV Year; 1 hr. lecture per week, second term.

Properties and the use of the various materials used in building are studied from the architectural rather than the structural viewpoint.

A small exhibition room has been set aside in which examples of the most modern materials and devices are displayed. This room is open to the student at all times.

Reference books: Architectural Construction, Vol. I—Voss and Henry. Brickwork—W. R. Jaggard. Materials and Methods of Architectural Construction—Gay and Parker. Building Construction—W. C. Huntington.

142. Sanitary Science. H. H. Madill.

Course 4, IV Year; 1 hr. lecture per week, both terms.

Modern plumbing, its design and installation, drainage, sewage disposal and water supply.

Reference books: Mechanical and Electrical Equipment for Buildings—Gay and Fawcett.

143. Professional Practice. H. H. Madill.

Course 4, V Year; 1 hr. lecture per week, both terms.

This subject is designed to give an understanding of the professional character of the practice of architecture. In it are discussed the ethical, business, and legal relations of the architect to clients, contractors, craftsmen, engineers, and the professional bodies. The customs of office practice are also discussed.

Reference books: Architectural Practice and Procedure—H. H. Turner. The Architects Law Manual—C. H. Blake. The Law of Architecture and Building—C. H. Blake. Handbook of Architectural Practice A.I.A. Contact Forms of R.A.I.C. Engineering Law—Laidlaw and Young. Architects' Specifications—Goldsmith.

144. Heating and Air Conditioning. A. Wardell.

Course 4, V Year; 1 hr. lecture per week, both terms.

In this subject the different systems of heating, ventilating, an d air conditioning of buildings are discussed.

145. Architectural Economics. W. S. Wilson.

Course 4, V Year; 1 hr. lecture per week, both terms.

Instruction in the various methods of preparing estimates, together with practical work in taking off quantities. Comparative costs of various types of materials and construction.

Building finance, revenue, and expenditure are also discussed.

147. Measured Drawings. E. R. Arthur.

Course 4, III Year.

Each student is required to submit, not later than the day of registration, a set of measured drawings of an existing building, along with the record of measurements and sketches neatly arranged in a note book. The subjects must be approved before measuring is begun. The study is marked as a separate subject, on the same basis as term work.

148. Outdoor Sketches. W. E. Carswell.

Course 4, IV Year.

Each student is required to submit, on or before the opening day of the session, a set of at least seven outdoor sketches in water colour, pen and ink, or pencil. The minimum size for each sheet will be 9″ × 12″. Of these sketches at least four will be in pencil and at least three will be of an architectural character.

ASSAYING, MINING, AND ORE DRESSING

The work in Mining is designed to give a thorough training in the underlying principles of Mining in its various branches, including exploration, development, and production. Special attention is paid to the practical and business aspects of these subjects.

The teaching of assaying has a two-fold function. The first is to give the student a working knowledge of the practice of the art, so that he can earn money as an assayer, upon graduation, and use this as a stepping-stone to other positions. The second is to use the assaying laboratories for the training of students in certain important phases of engineering methods. The size of the apparatus, the completeness of the processes in short intervals of time, the extreme accuracy of results when so desired, the relation of the

extent of error to time and method, the similarity of the academic laboratory to the field laboratory—all these permit an unrivalled opportunity for driving home much broad engineering philosophy. The assaying processes and apparatus lend themselves peculiarly well to the development of a proper perspective in regard to errors and accuracy in measurements.

160. Assaying. J. T. King.

Courses 2, 8, and 9, III Year; 1 hr. lecture per week, first term.

Theory and practice of fire assaying. Emphasis is laid not only upon the principles of chemistry, metallurgy and sampling involved, but also upon the errors inherent in operators as well as in methods.

References: Manual of Fire Assaying—Fulton and Sharwood. Textbook of Fire Assaying—Bugbee. Fire Assaying—Shepherd and Dietrich.

161. Assaying Laboratory. J. T. King.

Courses 2, 8, and 9, III Year; 3 hrs. laboratory per week, both terms.

Determination of precious metals. Some lecture instruction is given. Scorification and crucible assays of ores, pure and impure; and of milling and metallurgical products, including cyanide solutions. Buckboard practice on ores with metallics is given. Students are expected to do their later assays with despatch and a reasonable degree of accuracy.

162. Assaying. J. T. King.

Courses 2 and 8, IV Year; 1 hr. lecture per week, second term.

A continuation of subject 160. Complex ores; combination assays; assay of fluxes, of slags and cupels; checks and corrections; tailings assays; sampling and assay of bullion; organization for routine work.

163. Assaying Laboratory. J. T. King.

Courses 2 and 8, IV Year; 3 hrs. laboratory per week, second term.

An advanced laboratory subject in which some of the methods of subject 162 are used.

164. Assaying Laboratory. J. T. King.

Courses 6 and 8a, III Year; 3 hrs. laboratory per week, first six laboratory periods of first term; two lecture periods of 2 hrs. each for the first two Mondays of the session.

An introductory laboratory subject for chemical engineers. Some lecture instruction is given. An abbreviation of subjects 160 and 161.

165. Mining Laboratory. C. G. Williams, S. E. Wolfe.

Courses 2 and 9, I Year; 2 hrs. laboratory per week, first term.

A laboratory subject including some lectures, being an introduction to certain mining and milling machinery and methods.

166. Mining Laboratory. C. G. Williams, S. E. Wolfe.

Courses 2 and 9, IV Year; 3 hrs. laboratory per week, second term.

Special mining problems.

167. Mining. C. G. Williams.

Courses 2 and 9, II Year; 1 hr. lecture per week, first term. An introductory course of lectures.

168. Mining. S. E. Wolfe.

Courses 8, II Year; 1 hr. lecture per week, both terms.

Principles of Mining.

170. Mining. C. G. Williams.

Courses 2 and 9, III Year; 1 hr. lecture per week, both terms. Principles of mining.

171. Mining. C. G. Williams.

Courses 2 and 9, IV Year; 2 hrs. lectures per week, second term.

Special problems, estimates, reports.

172. Mine Management. C. G. Williams.

Courses 2 and 9, IV Year; 2 hrs. lectures per week, first term.

Consideration of organization, efficiency methods of operation, some of the business aspects of mining and pays particular attention to labour relations.

173. Mine Ventilation and Allied Problems. G. R. Lord.

Course 2, IV Year; 2 hrs. lectures per week, first term.

Ventilation problems in Canadian mines, including the use of ventilation equipment, selection of fans, testing equipment, ventilation studies, the silicosis problem, fire control, etc.

174. Mine Ventilation Laboratory. The Staffs in Mining and Mechanical Engineering.

Course 2, IV Year; 3 hrs. laboratory per week, first term.

Experiments in the laboratories and problems in the study room to give the student some practice in the use of ventilation test equipment, and the solution of ventilation problems.

175. Ore Dressing. C. G. Williams.

Courses 2 and 8, III Year; 2 hrs. lectures per week, second term.

The general principles of ore dressing.

176. Ore Dressing Laboratory. C. G. Williams, S. E. Wolfe.

Courses 2 and 8, III Year; 6 continuous hrs. laboratory per week, second term.

Work with crushing machinery, principles of crushing and grading, screen analyses, concentration with gravity separation apparatus, etc.

177. Ore Dressing. C. G. Williams.

Courses 2 and 8, IV Year; 1 hr. lecture per week, both terms.

Subject 175 continued, study of flow sheets, and special problems.

178. Ore Dressing. C. G. Williams, S. E. Wolfe.

Courses 2 and 8, IV Year; 6 continuous hrs. laboratory per week, first term.

Advanced work with ore dressing appliances, ore testing, and check mill runs.

180. Ore Dressing Laboratory. C. G. Williams, S. E. Wolfe.

Course 8a, IV Year; 3 hrs. laboratory per week, both terms.

Principles of sampling, crushing, and grading, screen analyses, concentration with gravity separation apparatus, flotation, ore testing, etc.

181. Principles of Ore Dressing. S. E. Wolfe.

Courses 2, 8 and 9, III Year; course 8a, IV Year; 2 hrs. lectures per week, first term.

Ore dressing methods involve a study of the laws governing the phenomena of surface tension, capillarity, and colloidal solutions, in addition to those of hydrostatics and certain phases of hydraulics. This is embodied in a special course of lectures in conjunction with laboratory work in the ore dressing laboratory.

182. Theory of Measurements. S. E. Wolfe.

Courses 2 and 9, II Year; 1 hr. lecture per week, first term.

This title is not an entirely suitable one for this subject because it is generally applied to a study of the philosophy of extremely accurate measurements. The mining engineer has to continually make satisfactory use of measurements with a wide range of inaccuracy. This subject deals with the philosophy underlying the causes of these errors and the practical application of such approximations. The opportunity is taken in these lectures to deal with the subject of illustrating measurements by graphs.

183. Introductory Research. C. G. Williams, S. E. Wolfe.

Course 2, III Year; 3 hrs. laboratory per week, second term.

A laboratory subject consisting of short experimental problems. It is designed to develop the individual student's initiative by his systematic observance of the effects of variables.

184. Summer Letters. C. G. Williams.

Course 2, III Year.

A series of letters written during the summer vacation, dealing with various aspects of a mining engineer's work. These are intended to direct and help the student's powers of observation, analysis, and criticism, as well as being exercises in the art of lucid technical expression.

Special instructions will be issued in connection with these letters.

185. Summer Essays. C. G. Williams.

Course 2, IV Year.

Special instructions will be given in connection with this work.

186. Problems and Seminar. The Staff in Mining Engineering.

Course 2, II, III, and IV Years; Course 9, II Year; 2 hrs. seminar per week, first term.

A seminar in which the students discuss technical and business problems, under their own supervision. A portion of the time is given to guest speakers on special subjects.

ASTRONOMY AND GEODESY

200. Practical Astronomy. S. R. Crerar.

Course 1, II Year; 2 hrs. lectures per week, second term.

Practical determination of time, latitude, and azimuth, by methods adapted to the use of the surveyor's transit. The subject will be designed to enable the student to carry out these observations at the Summer Survey Camp.

Reference books: Nautical Almanac, 1946. Printed Lecture Notes—S. R. Crerar.

201. Astronomy and Geodesy. S. R. Crerar.

Course 1, III Year; 2 hrs. lectures per week, second term.

Determination of time, latitude, longitude, and azimuth, by methods adapted to the use of the surveyor's transit and the sextant. It is designed to fulfil the requirements of the final examinations for Ontario and Dominion Land Surveyors.

In Geodesy an account is given of the principles and methods of a secondary triangulation survey, also of the principles involved in the North-west system of survey.

Text books: Practical Astronomy as applied to Geodesy and Navigation—Doolittle. Notes on Practical Astronomy and Geodesy. Nautical Almanac.

BOTANY

210. Properties of Living Matter. G. H. Duff.
Course 5r, III Year; 2 hrs. lectures per week, both terms.
Cellular and protoplasmic organization from both the structural and functional points of view.

211. Low Temperature Physiology. G. H. Duff.
Course 5r, IV Year; 1 hr. lecture per week, both terms.
Cryophilic organisms and the physiological and biochemical effects of low temperature.

212. Low Temperature Physiology Laboratory. G. H. Duff.
Course 5r, IV Year; 3 hrs. laboratory per week, both terms.
A laboratory subject supplementing subject 211.

CIVIL ENGINEERING

215. Municipal Engineering. A. E. Berry, P. H. Mills.
Course 1c, IV Year; 2 hrs. lectures per week, both terms; 5 hrs. laboratory per week, first term; 4 hrs. laboratory per week, second term.
Problems of water supply, sewerage, and municipal sanitation as viewed by the engineer. This subject includes the design of water distribution and sewer systems, as well as water and sewage treatment works. Municipal government, assessment and taxation, municipal finance, public utilities, expropriation, annexation problems, town planning, local improvement, and other laws relating to municipalities. Problems are assigned, from assumed data and from material secured in the field, to be worked out in the drafting room under subject 301.

216. Transportation Engineering. W. M. Treadgold, W. L. Sagar, R. F. Legget.
Course 1d, IV Year; 2 hrs. lectures per week, both terms; 5 hrs. laboratory per week, first term; 4 hrs. laboratory per week, second term.
Principles governing the location, design, and construction of railways, highways, airports, and inland waterways.

217. Water Power Engineering. R. F. Legget, G. R. Lord.
Course 1e, IV Year; 2 hrs. lectures per week, both terms; 5 hrs. laboratory per week, first term; 4 hrs. laboratory per week, second term (see subject 444).
Principal features of the hydraulic design of water power and water control projects, including hydrological studies, design of pipe lines, surge tanks, and canals; elements of water power machinery and water control equipment, together with the design of water-retaining structures such as earth and concrete dams.

CHEMISTRY AND CHEMICAL ENGINEERING

221. Chemistry. E. A. Smith, W. C. Macdonald, J. G. Breckenridge.

Courses 1, 2, 3, 5, 6, 7, 8, 8a, 9, and 10, I Year; 2 hrs. lectures per week, both terms.

Advanced chemical theory, with industrial and engineering applications.

222. Chemical Laboratory. L. J. Rogers, E. A. Smith, R. R. McLaughlin.

Courses 1, 3 and 7, I Year; 6 hrs. laboratory per week, one term.

Courses 2, 8 and 9, I Year; 6 hrs. laboratory per week, both terms.

Courses 6 and 8a, I Year; 9 hrs. laboratory per week, one term; 6 hrs. laboratory per week, other term.

Courses 5 and 10, I Year; 3 hrs. laboratory per week, both terms.

Quantitative experiments illustrating the use of the sensitive balance, and confirming the fundamental laws of chemistry; qualitative inorganic analysis; quantitative analysis.

223. Inorganic Chemistry. R. R. McLaughlin.

Courses 6, 8 and 8a, II Year; 1 hr. lecture per week, both terms.

A continuation of subject 221.

224. Chemistry. M. C. Boswell, J. G. Breckenridge.

Courses 2 and 9, II Year; 1 hr. lecture per week, both terms.

Organic—An introductory subject for the purpose of familiarizing the student with some of the principles and general reactions of organic chemistry, as illustrated in special cases arising in chemical industry.

Inorganic—A lecture subject dealing with fundamental chemical principles as applied to the treatment of ores and other mineral products.

225. Analytical Chemistry. L. J. Rogers.

Courses 2, 8 and 9, III Year; 1 hr. lecture per week, both terms.

Principles of chemical analysis; select gravimetric and volumetric methods; technical analysis.

226. Engineering Chemistry. R. R. McLaughlin.

Courses 3 and 7, II Year; 2 hrs. lectures per week, first term.

Water-softening, corrosion, petroleum, rubber, and plastics.

227. Analytical Chemistry Laboratory. E. A. Smith.

Courses 2 and 9, II Year; 3 hrs. laboratory per week, second term.

Gravimetric determination of metals and acids, with elementary volumetric analysis, accompanied by lectures.

228. Analytical Chemistry Laboratory. L. J. Rogers.
Course 8, II Year; 9 hrs. laboratory per week, both terms.
Course 8a, II Year; 12 hrs. laboratory per week, first term; 11 hrs. laboratory per week, second term.
Comprising gravimetric and volumetric methods, acidimetry and alkalimetry.
Text books: Analytical Chemistry, Vol. II—Treadwell-Hall. Qualitative Chemical Analysis—A. A. Noyes.

229. Chemical Laboratory. L. J. Rogers, F. E. Beamish, E. A. Smith, R. R. McLaughlin.
Course 6, II Year.
This subject will commence September 4, and will continue until September 22, 1945, the entire working week being spent in the laboratory on quantitative analysis.

230. Industrial Chemistry A. J. W. Bain.
Courses 6 and 8a, II Year; 1 hr. lecture per week, both terms.
Manufacture of acids, alkalies, and inorganic chemicals.

231. Industrial Chemistry B. E. A. Smith.
Courses 6 and 8a, II Year; 1 hr. lecture per week, second term.
Water softening, corrosion, explosives.

232. Industrial Chemistry and Technical Analysis. E. A. Smith.
Course 6, II Year; 11 hrs. laboratory per week, first term.
An introductory laboratory subject in industrial chemistry containing experiments on petroleum products, fertilizers, etc., colorimetric determination of hydrogen-ion, and stoichiometric calculations.

233. Engineering Chemistry. J. G. Breckenridge.
Course 1, II Year; 2 hrs. lectures per week, first term.
Water-softening, corrosion, explosives, rubber, and plastics.

234. Industrial and Laboratory Synthesis in Organic Chemistry. M. C. Boswell.
Course 6, II Year; 2 hrs. lectures per week, both terms.
A discussion of the chemical reactions used in synthesis in the laboratory and the factory, and of the conditions under which compounds are brought into reaction, the conditions used for securing high yields, and the methods employed for isolating compound from reaction mixtures both in the laboratory and in industry.

235. Industrial and Laboratory Methods of Synthesis. M. C. Boswell, R. R. McLaughlin, J. G. Breckenridge.
Course 6, II Year; 10 hrs. laboratory per week, second term.
A laboratory subject accompanying lecture subject 234.

236. Physical Chemistry. F. E. W. Wetmore.
Courses 6, 8, and 8a, II Year; Course 9, III Year; 2 hrs. lectures per week, both terms.
Elements of chemical mechanics, and the theory of solutions.

237. Analytical Chemistry Laboratory. L. J. Rogers.
Courses 2 and 9, III Year; 6 hrs. laboratory per week, first term; 3 hrs. per week, second term.
Course 8, III Year; 3 hrs. laboratory per week, first term.
Technical analysis of ores and furnace products.

238. Industrial Chemistry and Chemical Engineering.
Industrial Chemistry. E. A. Smith.
Course 6, III Year; 13½ hrs. laboratory per week, second term.
A continuation of subject 232, containing experimental work on coal, petroleum, illuminating gas, sugars, starch, etc., potentiometric determination of hydrogen-ion, and stoichiometric calculations. Instruction in glass blowing is given in this subject.
Chemical Engineering. Staff in Chemical Engineering.
Course 6, III Year; 30 hrs. laboratory.
A subject in Chemical Engineering introductory to subject 251.

239. Engineering Chemistry. E. A. Smith, R. R. McLaughlin, J. G. Breckenridge.
Course 11, II Year; 2 hrs. lectures per week, both terms.
Water softening, corrosion, petroleum, rubber plastics, sulphuric acid, alkalis, ammonia, and pulp and paper.

240. Chemical Theory. J. W. Bain, R. R. McLaughlin.
Courses 6 and 8a, III Year; 2 hrs. lectures per week, second term.
Chemical theory.

241. Industrial Chemistry. E. A. Smith.
Course 6, III Year; 1 hr. lecture per week, both terms.
Petroleum and its products, coal tar and its products, fats, oils, soap, sugar, starch, rubber, fermentation industries, etc.

242. Chemical Engineering. J. W. Bain.
Courses 6 and 8a, III Year; 2 hrs. lectures per week, first term.
The theory and practice of heat transfer, evaporation, filtration, and other industrial operations.
Text book: Elements of Chemical Engineering — Badger and McCabe.

244. Organic Chemistry, Industrial and Laboratory Synthesis. M. C. Boswell.
Course 6, III Year; 2 hrs. lectures per week, both terms.
A continuation of subject 234.

245. Industrial and Laboratory Methods of Synthesis in Organic Chemistry. M. C. Boswell, R. R. McLaughlin, J. G. Breckenridge.

Course 6, III Year; 10½ hrs. laboratory per week, first term.

Laboratory and industrial reactions are performed, in some cases using the following small scale industrial apparatus: filter press, sulphonator, tanks for precipitation, electric stirrer, vacuum evaporator, vacuum drier, fusion pot, ball mill, high pressure autoclaves, pumps for transferring liquids, and materials for constructing electric tube furnaces and thermocouples.

Text books: Manual of Industrial Chemistry (Organic)—Rogers. Practical Methods of Organic Chemistry—Gattermann. Unit Processes in Organic Synthesis—Groggins. Die Methoden der Organischen Chemie—Houben-Weyl.

246. Electrochemistry. F. E. W. Wetmore.

Courses 6 and 8, III Year; 16 lectures, first term.

Elementary electrochemistry.

247. Electrochemistry Laboratory. F. E. W. Wetmore.

Course 6, III Year; 18 hrs., first term.

Course 8, III Year; 3 hrs. per week, first term.

Quantitative measurements to accompany subject 246.

248. Chemical Engineering Thermodynamics. J. W. Bain.

Course 6, IV Year; 1 hr. lecture per week, both terms.

Chemical thermodynamics, dealing with problems in chemical engineering.

249. Catalysis in Organic Chemical Industry. M. C. Boswell.

Course 6, IV Year; 1 hr. lecture per week, both terms.

A continuation of subjects 234 and 244, and embracing as well a discussion of the methods used in several of the industries employing catalysts.

250. Organic Chemistry. R. R. McLaughlin.

Courses 5 and 8a, II Year; 1 hr. lecture per week, both terms.

General reactions and methods of synthesis of carbon compounds.

Text book: Chemistry of Organic Compounds—Conant.

251. Chemical Engineering and Industrial Organic Chemistry. Staff in Chemical Engineering.

Course 6, IV Year; 15 hrs. laboratory per week, first term.

Quantitative measurements, employing the following standard apparatus: still, heat interchanger, absorption column, and filter press. The experiments have been selected to furnish experimental data for the confirmation of some of the principles and mathematical expressions discussed in subject 242. The subject also includes experiments in industrial chemistry supplementary to subject 245.

252. Chemical Engineering Problems. J. W. Bain, W. C. Macdonald.

Course 6i, IV Year; 1 hr. laboratory per week, first term; 3 hrs. laboratory per week, second term.

Calculations in connection with various problems in chemical engineering.

253. Chemical Engineering. J. W. Bain, W. C. Macdonald.

Course 6i, IV Year; 1 hr. lecture per week, both terms.

A continuation of subject 242.

254. Research. The senior staff in Chemical Engineering.

Course 6i, IV Year; 5 hrs. laboratory per week, first term; 16 hrs. laboratory per week, second term.

In this subject, which occupies about three-quarters of the total time of the year, a research problem is given to each student. This provides experience in searching the primary sources of scientific information and in devising analytical methods and designing apparatus applicable to the new problems. Each student is obliged to write a thesis embodying the results of his search of the original literature and his own experimental work. Thus this subject serves as a preparation for the field of research work; and those students who, by ability, taste, and temperament, are fitted for research pass naturally either into industrial research or into the graduate school of the University to pursue further work in this field.

255. Electrochemistry. J. T. Burt-Gerrans.

Courses 6e and 8, IV Year; 1 hr. lecture per week, both terms.

Advanced theory of solutions and electrolysis, and the application to the practice of electro-deposition and electrolytic refining of metals. The subject also includes lectures on the electric furnace with special consideration of efficiency.

Reference books: Electrometallurgy — Borchers. Principles of Applied Electrochemistry—Allmand and Ellingham. The Electric Furnace — Stansfield. The Electric Furnace — Pring. Physical Chemistry for Colleges—Millard.

256. Electrochemistry Laboratory. J. T. Burt-Gerrans.

Course 6e, IV Year; 10 hrs. laboratory per week, first term; 22 hrs. laboratory per week, second term.

Course 8, IV Year; 3 hrs. laboratory per week, second term.

A laboratory subject accompanying subject 255.

Reference book: Practical Physical Chemistry—Findlay.

257. Silicate Chemistry. J. B. Ferguson.

Courses 8a and 9, IV Year; 2 hrs. lectures per week, first term.

The application of phase rule to the chemistry of refractory materials.

258. Industrial Chemistry. E. A. Smith, T. L. Crossley.

Course 6i, IV Year; 1 hr. lecture per week, first term.

Pulp and paper, and cellulose industries.

259. Chemical Theory. J. W. Bain, J. G. Breckenridge.

Course 6, IV Year; 1 hr. lecture per week, first term; 2 hrs. lectures per week, second term.

A course of lectures on the Phase Rule and atomic structure.

DESCRIPTIVE GEOMETRY, ENGINEERING PROBLEMS AND DRAWING

DESCRIPTIVE GEOMETRY

270. Descriptive Geometry. J R. Cockburn.

All Courses, I Year; 1 hr. lecture per week, both terms.

This subject deals chiefly with the principles of orthographic and oblique projections and the application of such principles to the solutions of problems relating to straight lines and planes.

272. Descriptive Geometry. J. R. Cockburn.

Courses 1, 2, 3, 4, 5, 7, 9, 10, and 11, II Year; 2 hrs. lectures per week, first term.

A continuation of the work taken in the First Year, with the following additions: problems relating to curved surfaces, principles of shades, shadows and perspective.

274. Descriptive Geometry. J. R. Cockburn.

Course 1, III Year; 1 hr. lecture per week, first term.

Spherical projections, the principles of mapmaking, and the graphical solution of spherical triangles.

ENGINEERING PROBLEMS AND DRAWING

These subjects consist primarily in the solving of problems by the student at the drafting table under the personal guidance of an instructor. The problems are intended to supplement certain lecture courses. The problems in the First and Second Years deal with the fundamental engineering studies—Mathematics, Applied Mechanics, Descriptive Geometry, the plotting of surveys that have been made by the students in the field, Theory of Mechanism, and Steam Engines, while in the Third and Fourth Years, the problems deal mainly with design. During the hours devoted to mathematical problems, members of the staff in mathematics are present to assist.

275. Engineering Problems and Drawing. A. Wardell.

Course 1, I Year; 14 hrs. per week, first term; 9 hrs. per week, second term.

Drawing and lettering. Plotting of original surveys. Problems in descriptive geometry. Graphical and analytical solutions of problems in applied mechanics. Problems in mathematics (analytical geometry and calculus).

276. Engineering Problems and Drawing. A. Wardell.
Courses 2 and 9, I Year; 6 hrs. per week, first term; 6 hrs. per week, second term.
Similar to subject 275.

277. Engineering Problems and Drawing. A. Wardell.
Course 3, I Year; 8 hrs. per week, first term; 15 hrs. per week, second term.
Similar to subject 275.

278. Engineering Problems and Drawing. A. Wardell.
Course 4, I Year; 3 hrs. per week, both terms.
Elementary drawing and lettering. The solving of a few problems in descriptive geometry, applied mechanics, and mathematics.

279. Engineering Problems and Drawing. A. Wardell.
Courses 5 and 10, I Year; 3 hrs. per week, first term; 6 hrs. per week, second term.
Drawing and lettering. Problems in descriptive geometry. Graphical and analytical solutions of problems in applied mechanics.

280. Engineering Problems and Drawing. A. Wardell.
Course 6, I Year; 4 hrs. per week, first term; 8 hrs. per week, second term.
Elementary drawing and lettering. The solving of a few problems in descriptive geometry, applied mechanics, and mathematics.

281. Engineering Problems and Drawing. A. Wardell.
Course 7, I Year; 11 hrs. per week, first term; 6 hrs. per week, second term.
Similar to subject 275.

282. Engineering Problems and Drawing. A. Wardell.
Course 8, I Year; 8 hrs. per week, first term; 7 hrs. per week, second term.
Similar to subject 275.

283. Engineering Problems and Drawing. A. Wardell.
Course 8a, I Year; 5 hrs. per week, first term; 7 hrs. per week, second term.
Similar to subject 280.

284. Engineering Problems and Drawing. J. J. Spence.
Course 1, II Year; 8 hrs. per week, both terms.
Problems in descriptive geometry—intersection of curved surfaces. Plotting of original surveys. Problems in mechanics of materials—properties of sections, designs of simple members. Problems in mathematics (calculus).

285. Engineering Problems and Drawing. J. J. Spence.
Courses 2 and 9, II Year; 8 hrs. per week, both terms.
Problems in descriptive geometry, mechanics of materials. Flow sheet.

286. Engineering Problems and Drawing. J. J. Spence.
Course 3, II Year; 8 hrs. per week, first term; 12 hrs. per week, second term.
Course 10, II Year; 6 hrs. per week, both terms.
Course 11, II Year; 6 hrs. per week, first term; 8 hrs. per week, second term.
Problems in descriptive geometry—intersection of curved surfaces. Problems in mechanics of materials, theory of mechanism, heat engines, electricity. Problems in mathematics (calculus).

287. Engineering Problems and Drawing. J. J. Spence.
Course 6, II Year; 3 hrs. per week, first term; 6 hrs. per week, second term.
Problems in mechanics of materials, electricity, and mathematics.

288. Engineering Problems and Drawing. J. J. Spence.
Course 7, II Year; 6 hrs. per week, first term; 3 hrs. per week, second term.
Similar to subject 286, but with more problems in mathematics.

289. Engineering Problems and Drawing. J. J. Spence.
Course 8, II Year; 3 hrs. per week, first term; 3 hrs. per week, second term.
Problems in mechanics of materials, electricity, and mathematics.

290. Engineering Problems and Drawing. J. J. Spence.
Course 8a, II Year; 5 hrs. per week, first term; 6 hrs. per week, second term.
Similar to subject 287.

291. Engineering Problems and Drawing. W. B. Dunbar.
Course 1, III Year; 10 hrs. per week, first term; 9 hrs. per week, second term.
Problems in design of steel structures, riveted and welded connections, tension members, beams, columns, highway and railway trusses. Problems in descriptive geometry to illustrate the theory of map making.

292. Engineering Problems and Drawing. W. B. Dunbar.
Course 2, III Year; 3 hrs. per week, first term; 3 hrs. per week, second term.
Problems in design of steel structures, riveted and welded connections, tension members, beams, columns.

293. Structural Design Drawing. W. B. Dunbar.
Course 3, III Year; 3 hrs. per week, both terms.
Similar to subject 292.

296. Engineering Problems and Drawing. W. B. Dunbar.
Courses 5r and 8, III Year; 3 hrs. per week, second term.

297. Engineering Problems and Drawing. W. B. Dunbar.
Course 8a, III Year; 3 hrs. per week, both terms.

298. Engineering Problems and Drawing, Structural. W. B. Dunbar, P. V. Jermyn.
Course 1a, IV Year; 10 hrs. per week average, both terms.
Advanced problems on the design of steel and reinforced concrete structures—floor panels, mill buildings, tanks, reservoirs, towers, truss and arch bridges, foundations, dams, retaining walls, wind bracing. Problems on moment distribution in rigid frames, influence lines, and deflection of trusses.

299. Structural Design Drawing. W. B. Dunbar, P. V. Jermyn.
Courses 3 and 11, IV Year; 3 hrs. per week, first term.
Problems on the determination of stresses in, and the design of mill, building, flume trestles, crane runways, and floor panels for machinery loading.

300. Plant Design. R. J. Montgomery.
Course 8a, IV Year; 3 hrs. per week, second term.
Original design of ceramic plants, driers, kilns, etc.

301. Engineering Problems and Drawing, Sanitary. A. E. Berry, M. W. Huggins.
Course 1c, IV Year; 3 hrs. per week, both terms.
Problems on the design of water distribution and sewer systems as well as water and sewage treatment works.

302. Structural Design Drawing. W. B. Dunbar.
Course 11, III Year; 6 hrs. per week, first term; 3 hrs. per week second term.
Similar to subject 292.

ECONOMICS, BUSINESS ADMINISTRATION, AND LAW

307. Accounting and Statistics.
Course 11, III Year; 3 hrs. lectures and 2 hrs. laboratory per week, both terms.
An introduction to the theory and practice of accounting, particularly as applied to corporations, and to the methods of collection, presentation, analysis, and interpretation of statistics as applied to business problems.

308. Applied Economics.

Course 11, III Year; 2 hrs. lectures per week, both terms, 2 hrs. laboratory per week, second term.

The economics of the individual firm; the capital market, the labour market, and typical commodity markets; problems of industrial fluctuation.

309. Business Policy.

Course 11, IV Year; 2 hrs. lectures per week, first term; 3 hrs. lectures per week, second term; 3 hrs. laboratory per week, first term; 4 hrs. laboratory per week, second term.

A discussion of the organization of business enterprises, particularly in the field of manufacturing industry; problems of internal administration; relations with other firms and with governments; use of accounting and statistical data in connection with business problems.

310. Business. R. R. Grant.

Courses 1, 2, 3, 6, 7, 8, 8a and 9, III Year; 1 hr. lecture per week, second term.

Elements of business and the basic organization thereof with an introduction to the principles of control through accounting records. The preparation of simple financial statements and explanations of the purpose of the information shown therein. A brief description of the use of business papers such as invoices, bills of exchange, and others.

311. Economics. V. W. Bladen.

All courses, II Year; 2 hrs. lectures per week, both terms.

An introduction to the study of Economics with special reference to the problems of the Canadian economy.

Text book: An Introduction to Political Economy—Bladen.

312. Commercial Law. F. C. Auld.

Course 4, III Year; 1 hr. lecture per week, both terms.

General Principles of the Law of Contracts, Principal and Agent, Partnership and Limited Companies, with special reference to the Companies Acts. General view of the following:—Negotiable Instruments, Sale of Goods, Bills of Sale and Chattel Mortgages, Suretyship and Guarantee.

Text book: Manual of Canadian Business Law—Falconbridge and Smith.

313. Engineering Economics. C. R. Young.

Courses 1, 2, 3, 7, 8, 9, and 11, IV Year; 1 hr. lecture per week; second term.

Principles by which the economic practicability of a project is judged and the comparison of competing proposals is made. Consideration is given to first cost and annual cost, methods of estimating, fixed charges and operating expenses, financing of engineering projects, valuation and appraisals. Special attention is given to depreciation and the methods of providing for it. Typical numerical problems are discussed and solved.

Text books: Engineering Economics—Fish. Financial Engineering—Goldman. Principles of Engineering Economy—Grant.

314. Engineering Law. P. H. Mills.

Courses 1, 3, 6, 7, and 11, IV Year; 1 hr. lecture per week, first term.

A subject designed to co-ordinate engineering practice and law. In the work that is common to all students taking the subject attention is directed to the duties and liabilities of the engineer, workmen's compensation, patents and inventions, copyrights, trade marks, industrial designs, promotion of companies, organization of companies, arbitration, expert evidence, trade unions, combines, and industrial disputes.

Text book: Engineering Law—Laidlaw and Young.

315. Contracts and Specifications. R. F. Legget.

Courses 1 and 4, IV Year; 1 hr. lecture per week, second term.

Fundamental principles of contract and specification writing. The critical examination of typical specifications and agreements by the class, forms an essential feature of the instruction.

Text book: Engineering Law—Laidlaw and Young.

316. Introduction to Management. R. F. Legget.

Course 1, IV Year; Course 4, V Year; 1 hr. lecture per week, both terms.

Lectures dealing with the fundamental principles upon which management is based. Examples are so selected as to provide an introduction to construction practice. The second half is devoted principally to personnel problems and practices in industry and construction. A selected list of required reading is provided.

317. Plant Management. C. G. Williams.

Course 8, IV Year; 1 hr. lecture per week, second term.

Twelve lectures dealing with some phases of labour, plant organization.

318. Industrial Management. E. A. Allcut.

Courses 3, 6, 7 and 8a, IV Year; 1 hr. lecture per week, both terms.

A study of industrial organization, location, arrangement, construction, and equipment of industrial plants for efficiency and

economy, process routing, scheduling work, reports, methods of superintending, employment, systems of compensating labour, and systems of distributing indirect expenses.

Text book: Principles of Industrial Management—Allcut.

320. Public Speaking. G. A. McMullen, W. C. Macdonald, A. M. Fitzgerald.

Course 11, II Year; 1 hr. lecture per week, second term.
Course 4, III Year; 1 hr. lecture per week, both terms.
Course 6, IV Year; 1 hr. lecture per week, both terms.

Principles of public speaking and the means of expression, accompanied by practical application and training in actual speaking.

322. Engineering and Society. C. R. Young, H. A. Innis.

All courses, I Year; 1 hr. lecture per week, both terms.

A series of lectures on economic history intended to show the dynamic role of science and technology in the development of the modern world, and the slow adaptation of social institutions under the impact of rapid technological change. Some attention will be given to the evolution of the more important branches of engineering and the origin of important existing practices and procedures.

323. Introduction to Political Science. R. MacG. Dawson.

All courses, III Year; 1 hr. lecture per week, both terms.

An introduction to the study of government with special reference to the problems of Canadian government.

324. Modern World History. E. W. McInnis.

All Courses, III Year; 1 hr. lecture per week, both terms.

An outline of the chief trends and developments since the beginning of the 19th Century, with emphasis on Britain, the United States, and the main aspects of international relations.

325. Modern Political and Economic Trends. L. T. Morgan, J. E. Hodgetts.

All courses, IV Year; 1 hr. lecture per week, both terms.

A study of recent economic and political trends with particular reference to developments in the United States under the New Deal, in Italy since 1922, and in Russia since 1919.

326. Philosophy of Science. G. Edison.

Courses 1, 2, 3, 5, 6, 7, 8, 8a, 9, 10, and 11, IV Year; Course 4, V Year; 18 lectures, first term, and part of second term.

Origin and development of scientific method; the range of the sciences; logical principles and the analysis of fundamental concepts; problems of life, mind and society.

327. The Profession of Engineering. C. R. Young, R. F. Legget.

Courses 1, 2, 3, 5, 6, 7, 8, 8a, 9, 10, and 11, IV Year; 6 lectures, second term.

Professional engineering organizations in Canada; engineering societies and services; professional ethics; social implications of engineering; the engineer and conservation.

328. Industrial Management I.

Course 11, III Year; 1 hr. lecture and 2 hrs. laboratory per week, first term; 2 hrs. lectures and 1 hr. laboratory per week, second term.

An introduction to industrial organization and management, dealing particularly with its more technical aspects. Such problems as plant location, layout, arrangement, construction, handling of materials, inspection, design, and report writing are dealt with.

Text book: Principles of Industrial Management—Allcut.

329. Industrial Management II.

Course 11, IV Year; 3 hrs. lecture and 3 hrs. laboratory per week, both terms.

A continuation of subject 328, dealing with such matters as production, planning, time and motion study, costs, budgetary control, and payment of labour. Particular emphasis is placed upon the study of Industrial Relations.

ELECTRICITY

330. Electricity. D. N. Cass-Beggs, R. Scott.

Courses 1, 2, 3, 5, 6, 7, 8, 8a, 9 and 10, I Year; 2 hrs. lectures per week, both terms.

Principles relating to electric circuits, magnetic circuits, instruments, and apparatus in general, with illustrations from commercial practice. The point of view is quantitative rather than descriptive.

Reference books: Introduction to Electrical Engineering—Mueller. Electrical Engineering—Christie.

331. Alternating Currents. A. R. Zimmer, L. S. Lauchland.

Courses 1, 2, 8 and 9, II Year; 1 hr. lecture per week, both terms.

Fundamental calculations of alternating current circuits and various applications of interest to those who are not making electricity a major subject.

332. Electricity. J. E. Reid.

Courses 3, 5, 6, 8, 8a, and 11, II Year; 2 hrs. lectures per week, first term.

Course 7, II Year; 2 hrs. lectures per week, second term.

General principles and calculation of electrical circuits, particularly as applied to the measurement of resistance, current, potential difference, inductance, capacity, power, and energy. The principles

underlying commercial instruments are considered, together with the methods of calibration.

Reference books: Electrical Measurements—Laws. Electrical Measurements in Theory and Application—Smith. Electrical Measurements and Measuring Instruments—Golding.

333. Electrical Fundamentals. J. E. Reid.

Course 7, II Year; 2 hrs. lectures per week, both terms.

A series of lectures extending the study of the fundamental principles underlying the work of subject 332. Applications considered are of particular interest to electrical engineers.

334. Electrical Measurements Laboratory. J. E. Reid.

Courses 3, 5, 6, 8, 8a, and 11, II Year; 3 hrs. laboratory per week, first term.

Course 7, II Year; 6 hrs. laboratory per week, second term.

The more important methods of measurement of resistance, current, potential difference, inductance, and capacity are used, often under conditions such as occur in practice. The principles of measurement are applied to other problems such as the location of line faults and the measurement of temperature rise by resistance changes. Methods of calibrating commercial instruments are also included.

336. Mathematical Applications in Electrical Engineering. V. G. Smith.

Course 7, III Year; 3 hrs. lectures per week, second term.

These lectures are intended to co-ordinate certain branches of mathematics, such as complex numbers, simple determinants, and elementary differential equations, with their applications to the problems of electrical engineering.

337. Electronics. J. E. Reid.

Courses 5c, 5i, 5s, and 7, III Year; Course 5r, IV Year; 3 hrs. lectures per week, second term.

The behaviour of electrons in electric and magnetic fields and the applications of electronics to electrical engineering.

338. Direct Current Machines. A. R. Zimmer.

Courses 3 and 11, II Year; Course 10, III Year; 2 hrs. lectures per week, second term.

Courses 3 and 11, II Year; 3 hrs. laboratory per week, second term.

A course on the theory and operation of direct current generators and motors.

Reference books: Electrical Engineering, Vol. I—Dawes. Electrical Circuits and Machinery, Vol. I—Morecroft and Hehre Elements of Electrical Engineering—Cook.

339. Direct Current Machines. A. R. Zimmer.

Courses 5 and 7, III Year; 2 hrs. lectures per week, first term.

The theory and operation of direct current machines. Methods of calculating the operating characteristics of generators and motors are presented and illustrated by the use of problems.

Reference books: Electrical Engineering, Vol. I—Dawes. Electrical Circuits and Machinery, Vol. I—Morecroft and Hehre. Principles of D.C. Machines—Langsdorf. Direct Current Machinery—Pender. Electrical Engineering—Christie. Elements of Electrical Engineering—Cook. D.C. Machinery—Kloeffler, Brenneman and Kerchner. Direct Current Machinery—McFarland. Direct Current Machinery—Bull.

340. Alternating Currents. A. R. Zimmer.

Courses 3, 5r, 10, and 11, III Year; 2 hrs. lectures per week, first term.

Courses 6 and 8a, III Year; 2 hrs. lectures per week, first term.

Measurements in simple single-phase and polyphase circuits. Circuit problems are solved by analytical and graphical methods. The operation of induction and synchronous motors and transformers is discussed briefly.

Reference books: Electrical Engineering, Vol. II—Dawes. Electrical Circuits and Machinery, Vol. II—Morecroft and Hehre. Elements of Electrical Engineering—Cook.

341. Alternating Currents. A. R. Zimmer.

Courses 5c, 5g, 5i, 5s, and 7, III Year; 2 hrs. lectures per week, both terms.

A first course of lectures on alternating current, covering principles of measurement and leading to the analytical and graphical treatment of the simpler problems relative to alternating-current circuits and machinery.

Reference books: Electricity and Magnetism for Engineers, Part II—Pender. Electrical Engineering—Christie. Electrical Engineering, Vol. II—Dawes. Electrical Circuits and Machinery, Vol. II—Morecroft and Hehre. Alternating Current Circuits—Kerchner and Corcoran. Alternating Current Circuits—Bryant, Correll and Johnson. Alternating Current Electrical Engineering—Maccall. Alternating Current Electrical Engineering—Kemp. Elements of Electrical Engineering—Cook.

342. Electrical Design. R. J. Brown., R. Scott.

Courses 5c, 5i, 5s and 7, III Year; 2 hrs. lectures per week, first term.

Course 7, III Year; 6 hrs. laboratory per week, first term.

Derivation and application of formulae used in the design of magnets, direct current machines, transformers, and other electrical equipment.

343. Electrical Problems and Seminar. V. G. Smith, A. R. Zimmer.
Course 7, III Year; 3 hrs. per week, both terms.

344. Electrical Laboratory. H. W. Price, A. R. Zimmer, R. G. Anthes.
Courses 5c, 5g, 5i and 5s, III Year; 6 hrs. laboratory per week, both terms.

Course 7, III Year, 6 hrs. laboratory per week, first term; 3 hrs. laboratory per week, second term.

A group of experiments on direct current machines, another group on the fundamentals of alternating current circuits, together with experiments on properties of magnetic materials, and on the fundamentals of electronic devices. Introductory experience in the use of alternating current machinery is afforded.

345. Alternating Current Machinery. H. W. Price.
Courses 3, III Year; Course 11, IV Year; 2 hrs. lectures per week, second term.

Characteristics of alternating current machines and the various methods of control.

346. Electrical Laboratory. H. W. Price, A. R. Zimmer.
Course 3, III Year; 3 hrs. laboratory per week, both terms.
Course 11, III Year; 3 hrs. laboratory per week, first term.
Course 11, IV Year; 3 hrs. laboratory per week, second term.
Experiments on alternating current circuits and machines.

347. Electrical Laboratory. H. W. Price, A. R. Zimmer.
Course 5r, III Year; 3 hrs. laboratory per week, both terms.
A modified subject based on subject 344.

348. Electrical Machinery. H. W. Price.
Courses 2 and 8, III Year; 2 hrs. lectures per week, first term.

Lectures and demonstrations dealing with the operation and characteristics of electrical machinery.

349. Electrical Laboratory. H. W. Price, A. R. Zimmer.
Courses 6 and 8a, III Year; 3 hrs. laboratory per week, first term.

Experiments on direct current generators and motors, and alternating current circuits and machines.

350. Electrical Laboratory. H. W. Price, A. R. Zimmer.
Courses 1, 2, 8 and 9, II Year; 3 hrs. laboratory per week, second term.

Experiments planned to give a general knowledge of the operation of direct current machines, simple alternating current circuits, and alternating current machines.

351. Alternating Current Circuit Analysis. V. G. Smith.

Courses 5c and 7, IV Year; 2 hrs. lectures per week, both terms.

Applications of advanced analytical methods made to a.c. bridges, electrical filters, and other networks. Several general network theorems are obtained. The method of symmetrical components is developed and used to solve problems involving unbalance in three-phase circuits. Complex wave forms of voltage and current and their analysis are considered in detail. Simple transients in a.c. circuits are also studied.

Reference books: Principles of Alternating Currents—Lawrence. Alternating Current Circuits—Weinbach. Alternating Current Bridge Methods—Hague. Symmetrical Components—Wagner and Evans. Alternating Current Circuits—Kerchner and Corcoran.

352. Electrical Transmission of Energy. V. G. Smith.

Courses 5c and 7, IV Year; 2 hrs. lectures per week, first term.

The essential factors involved in the electrical transmission of energy. The distributed inductance and capacity of a three-phase transmission line are found. The behaviour of a long line when the voltages and currents are sinusoidal is examined in detail. Graphical constructions are developed and applied to both short and long lines.

Reference books: Transmission Line Theory—Franklin and Terman. Principles of Transmission in Telephony—Weinbach.

353. Alternating Current Machinery. D. N. Cass-Beggs.

Courses 5r and 7, IV Year; 2 hrs. lectures per week, both terms.

A course of lectures on the theory and performance of alternating current power transformers; synchronous generators, motors, and converters; single and polyphase asynchronous motors.

Reference books: Theory of Alternating Current Machinery—Langsdorf. Principles of Alternating Current Machinery—Lawrence. Alternating Current Machines—Puchstein and Lloyd. Alternating Current Machinery—Bryant and Johnson. Electrical Engineering—Christie.

354. Alternating Current Measurements. J. E. Reid.

Course 7, IV Year; 2 hrs. lectures per week, first term.

A.c. bridges for the measurement of inductance, capacitance, resistance, power factor, frequency, etc. The theory, use, and calibration of instrument transformers are covered. The measurement of power, reactive power, and associated quantities in polyphase circuits is discussed.

355. Electrical Laboratory. H. W. Price, A. R. Zimmer, D. N. Cass-Beggs.

Course 7, IV Year; 6 hrs. laboratory per week, both terms.

Studies of principles and properties of single-phase and polyphase circuits and apparatus. Vector and analytical methods are applied

to the solution of problems related to the characteristics of transformers, alternators, synchronous motors, converters, induction motors, transmission lines, and other alternating current equipment. The principles and properties of electronic equipment used in low frequency and power fields, such as mercury arc rectifiers and thyratrons, are studied.

Reference books: Electrical Engineering—Christie. Experimental Electrical Engineering, Vols. I and II—Karapetoff. Principles of A.C. Machinery—Lawrence. A.C. Machinery—Bryant and Johnson. Principles of Alternating Current Machinery—Langsdorf.

356. Electrical Laboratory. H. W. Price, A. R. Zimmer, D. N. Cass-Beggs.

Course 5c, IV Year; 6 hrs. laboratory per week, both terms.

A modified course based on subject 355.

357. Engineering Electronics. D. N. Cass-Beggs.

Course 7, IV Year; 1 hr. lecture per week, first term; 2 hrs. lectures per week, second term.

Electronic devices, such as the thyratron, ignitron and mercury arc rectifier, and their application to engineering problems.

Reference books: Electron Tubes in Industry—Henney. Fundamental Electronics and Vacuum Tubes—Albert. Fundamentals of Engineering Electronics—Dow. Applied Electronics—E. E. Staff, M.I.T.

358. Electrical Design. R. J. Brown.

Course 7, IV Year; 1 hr. lecture and 3 hrs. laboratory per week, second term.

A continuation of subject 342.

359. Seminar.

Course 7, IV Year; 3 hrs. per week, both terms.

361. Communication. B. deF. Bayly, V. G. Smith, R. G. Anthes.

Courses 5c, 5s and 7, IV Year; 2 hrs. lectures per week, both terms.

Course 5i, IV Year; 2 hrs. lectures per week, first term.

This subject has been arranged so that the work of the first term includes tubes and circuits for amplification, detection, modulation, etc., while the work of the second term covers fundamental communication networks such as filters, bridges and impedance-matching networks.

Reference books: Communication Engineering—Everitt. Fundamentals of Vacuum tubes—Eastman. Fundamentals of Engineering Electronics—Dow. Communication Networks, Vols. I and II—Guillemin. High Frequency Measurements—Hund.

362. Communication Laboratory. B. deF. Bayly, V. G. Smith, R. G. Anthes.

Courses 5c, 5s and 7, IV Year; 3 hrs. laboratory per week, both terms.

Course 5i, IV Year; 3 hrs. laboratory per week, first term.

Principles of measurement and demonstrations of principles described in lecture subject 361.

For the duration of the war, students who obtain honours in the third year, or are otherwise qualified, and who are planning to enter some technical branch of war service connected with communication, may be permitted to do special additional work in the Communication Laboratory. This will include ultra-high frequencies, and such other work as may be arranged by the Department.

364. Operational Methods. V. G. Smith.

Courses 5c, 5i and 5s, IV Year; 2 hrs. lectures per week, both terms.

A few examples of earlier operational methods are given. The operators of electric circuits are developed and solutions obtained, in the course of which several useful rules concerning shifting and transfer operations, and differentiation and integration with respect to parameters are found and applied. The Heaviside expansion theorem is developed in a simple manner. The connection between Heaviside's methods and the classical methods of Fourier Integrals and Contour Integration is investigated in some detail. Application is made throughout to engineering problems, chiefly in the field of electric circuit analysis.

Reference books: Electromagnetic Theory—Heaviside. Operational Circuit Analysis—Bush. Electric Circuit Theory and the Operational Calculus—Carson. Heaviside's Operational Calculus—Berg. Fourier Integrals for Practical Applications—Campbell and Foster.

365. Applied Electromagnetic Theory. V. G. Smith.

Courses 5c, 5g and 5s, IV Year; 2 hrs. lectures per week, both terms.

The laws of electromagnetism are reviewed and Maxwell's field equations developed. Plane electromagnetic waves and their reflection and refraction at plane surfaces are studied. Skin effects in cylindrical conductors, both solid and hollow are considered. Transmission of energy by wave guides and co-axial cables is investigated. The laws and formulae of the radiation of energy from vertical antennae are developed. The capacity of cables and transmission lines is computed and comparison made between the exact and approximate formulae. Magnetic fields due to conductors carrying current in the neighbourhood of ferromagnetic bodies are investigated in some of the more simple cases.

Reference books: Electromagnetic Theory—Heaviside. Electromagnetic Theory—Stratton. Electromagnetic Problems in Electrical Engineering—Hague.

366. Aircraft Electricity. J. E. Reid.
Course 10, IV Year; 1 hr. lecture per week, second term.
Types of electrical equipment used in aircraft and airports, and with the principles of aircraft radio equipment such as the radio range, radio compass, radio altimeter, direction finding, etc.

367. A. C. Machinery Laboratory. D. N. Cass-Beggs.
Course 5r, IV Year; 3 hrs. laboratory per week, first term.
A short laboratory course in alternating current electrical machinery.

368. Electronics Laboratory. D. N. Cass-Beggs, J. E. Reid, R. G. Anthes.
Course 5r, IV Year; 3 hrs. laboratory per week, second term.
A short laboratory course in electronics, vacuum tubes, and engineering electronics.

GEOLOGY

380. Geological Field Work. E. S. Moore.
Courses 2 and 9, III Year; one week at the University Survey Camp preceding the opening of the first term.

381. Geology, Pleistocene and Physiographic. A. MacLean.
Courses 2 and 9, IV Year; 1 hr. lecture per week, both terms.
Pleistocene Geology. The formation and distribution of the drift deposits of North America, with brief references to other regions.
Physiography. The surface forms of the earth, and the geological factors that have produced them.
Reference books: Ice Ages, Recent and Ancient, and The Last Million Years—Coleman. Physiography—Salisbury.

382. Geological Excursions. A. MacLean.
Courses 2 and 9, IV Year.
During October weekly trips will be made to points of interest near Toronto.

383. Historical Geology. M. A. Fritz.
Course 9, III Year; 2 hrs. lectures per week, both terms.
Principles of sedimentation, divisions of the geological column, and the use of fossils in correlation of formations.
Textbook: Historical Geology—Schuchert and Dunbar.

384. Historical Geology Laboratory. M. A. Fritz.
Course 9, III Year; 2 hrs. laboratory per week, both terms.
Study of fossils, sediments, and geological maps and sections. A laboratory course to accompany subject 383.

385. Engineering Geology. A. MacLean.
Courses 1 and 5g, III Year; 1 hr. lecture per week, first term; 2 hrs. lectures per week, second term.
Structural, dynamic and economic geology, with special reference to engineering problems.
Reference books: Engineering Geology—Ries and Watson. Geology and Engineering—Legget.

386. Engineering Geology Laboratory. A. MacLean.
Courses 1 and 5g, III Year; 2 hrs. laboratory per week, second term.
Specimens, maps, and sections to accompany subject 385.

388. General Geology. G. B. Langford.
Courses 2 and 9, II Year; 2 hrs. lectures per week, first term; 1 hr. lecture per week, second term.
Geological principles, designed to introduce the student to the study of geology.
Reference books: Geology—Emmons, Thiel, Stauffer, and Allison. Elementary Geology for Canada—Moore.

389. General Geology. G. B. Langford.
Courses 2 and 9, II Year; 2 hrs. laboratory per week, second term.
Maps and sections; accompanying subject 388.

390. Structural Geology. G. B. Langford.
Courses 2 and 9, III Year; Course 5g, IV Year; 2 hrs. lectures per week, first term.
Structures caused by the deformation of the earth's crust.
Text books: Geologic Structures—Willis. Structural Geology—Nevin.

391. Structural Geology. G. B. Langford.
Course 2, III Year; 3 hrs. laboratory per week, first term.
Course 9, III Year; Course 5g, IV Year; 3 hrs. laboratory per week, both terms.
Work with geological maps of folded and faulted areas, structure sections, and the solution of problems relating to folding and faulting. Laboratory course to accompany subject 390.

392. Precambrian Geology. E. S. Moore.

Courses 2 and 9, IV Year; 2 hrs. lectures per week, first term.

Precambrian formations of Canada—their rocks, distribution, relationships, and economic features. Briefer accounts are given of similar formations in the United States and elsewhere.

Reference books: Publications of the Dominion and Provincial geological surveys. Mineral Deposits of the Canadian Shield—Bruce.

393. Mining Geology. G. B. Langford.

Course 9, IV Year; 2 hrs. lectures per week, first term; 1 hr. lecture per week, second term.

Detailed study of the geology of Canadian and foreign mining camps.

394. Mining Geology. G. B. Langford.

Course 9, IV Year; 3 hrs. laboratory per week, both terms.

A laboratory course to accompany subject 393.

396. Mining Geology. E. S. Moore.

Course 2, IV Year; 2 hrs. lectures per week, second term.

Geological problems associated with mining, typical mining regions in Canada, the United States, and elsewhere discussed from the geological side.

Reference books: Gold Fields of the World—Emmons. Mineral Deposits—Lindgren.

397. Precambrian and Economic Geology Laboratory.

Course 9, III Year; 2 hrs. laboratory per week, second term.

Special attention to Precambrian formations and the microscopic features of the rocks and mineral deposits.

398. Economic Geology. E. S. Moore.

Course 9, III Year; Department 5g, IV Year.

(*a*) Ore Deposits: 1 hr. lecture per week, both terms.

Discussion of the origin and classification of ore deposits, the mode of occurrence of the chief ores, and statistics of production. Special attention is given to the metals mined in Canada.

(*b*) Economic Geology of the non-metals: 2 hrs. lectures per week, second term.

The origin and mode of occurrence of the valuable non-metallic substances—coal, oil, building stone, gypsum, cement materials, etc.

Reference books: Economic Geology — Ries. Coal — Moore. Geology of Petroleum and Natural Gas—Lilley. Mineral Resources of Canada—Moore. Introduction to the Study of Ore Deposits—Hatch.

399. Economic Geology. E. S. Moore.
Course 2, III Year.
(*a*) Ore Deposits: 1 hr. lecture per week, both terms.
(*b*) Economic Geology of the non-metals: 1 hr. lecture per week, second term.
Similar to subject 398.

400. Economic Geology Laboratory. G. B. Langford.
Course 9, III Year; Course 5g, IV Year; 3 hrs. laboratory per week, both terms.
Ores, geological features of mining areas, interpretation of drill logs, geological maps, and structure sections. Excursions are included.

401. Location of Mineral Deposits. E. S. Moore.
Course 5g, IV Year; 1 hr. lecture per week, second term.
Geological features and principles involved in the application of geophysical methods in the search for mineral deposits, and the interpretation of the structure of the earth's crust.

402. Economic Geology. G. B. Langford.
Course 8a, IV Year; 2 hrs. lectures per week, second term.
The nature, occurrence, and origin of non-metallic deposits, excepting fuels.
Reference book: Industrial Minerals and Rocks—A.I.M.E.

403. Geology of Canada. A. MacLean.
Course 9, IV Year; 2 hrs. lectures per week, first term; 1 hr. lecture per week, second term.
A survey of the physiography, historical geology, major structural features, and mineral deposits of the country.

404. Geology of Canada. A. MacLean.
Course 9, IV Year; 2 hrs. laboratory per week, second term.
Accompanying subject 403.

405. Building Materials; Stones. E. S. Moore.
Course 4, IV Year; 1 hr. per week, first term.
Lectures and laboratory work on decorative and structural stones used in building; their properties, sources, extraction, and preparation for use in buildings.
Reference book: Building Stones and Clay Products—Ries.

HEAT ENGINES

420. Elementary Heat Engines. E. A. Allcut, W. A. Wallace.
Courses 3, 10, and 11, II Year; 2 hrs. lectures per week, second term.

Courses 2, 7, 8 and 9, II Year; 1 hr. lecture per week, first term.

The history and development of heat engines generally, the principles upon which they operate, and brief descriptions of the mechanical and thermal features of the different kinds of heat engines used in practice.

Text book: An Introduction to Heat Engines—Allcut.

421. Theory of Heat Engines. E. A. Allcut.

Courses 3, 5r, 6, 7, 8a, 10, and 11, III Year; 2 hrs. lectures per week, both terms.

The application of the laws of thermodynamics, indicating the best conditions for heat engine operation and the maximum possible efficiency, as exemplified by the Carnot and regenerative cycles. The properties of working fluids are studied, and the effect of departures from the perfect cycle is illustrated by the Joule, Otto, Diesel, and Rankine cycles. The uses of entropy diagrams and refrigeration cycles are also considered.

422. Heat Engineering. R. C. Wiren.

Course 3, III Year; 1 hr. lecture per week, both terms.

Internal combustion engines. Types and operation; performance and testing; basic characteristics and principles of design; carburetion; fuel injection; governing.

Steam Turbines. Types and basic characteristics; condensers; cooling towers.

Course 3, III Year; 1 hr. lecture per week, first term.

Steam generators and plant. Combustion calculations; analysis of fuels and products of combustion; boiler tests and heat balance; principles of design and commercial types of boilers, furnaces, stokers, pulverized fuel equipment, economizers, air heaters, super-heaters, etc.

Text book: Heat Engines—Allen and Bursley.

Course 3, III Year; 1 hr. lecture per week, second term.

Air conditioning. Air and water vapour mixtures; requirements for comfort and industrial processes; the use of psychrometric charts; heat transmission calculations; heating, cooling, humidifying, and dehumidifying processes; calculation of air conditioning loads; air conditioning systems and equipment.

Text book: Air Conditioning—Holmes.

423. Heat Engine and Mechanical Laboratory. R. C. Wiren, I. W. Smith.

Courses 3, 5r, and 10, III Year; 1 three-hr. laboratory period per week, both terms.

Course 7, III Year; 1 three-hr. laboratory period per week, first, term.

Course 11, III Year; 1 three-hr. laboratory period per week, second term.

A laboratory subject designed to assist in a clearer understanding of thermodynamics, machine design, and mechanics of machinery. The work on heat engines includes the setting of slide valves, indicating engines, measuring the brake horse-power, simple engine tests, and the testing of internal combustion engines under various conditions. The mechanical laboratory work deals with the efficiency of belts as well as of several machines of simple construction. An examination of lubricating oils is also made by means of well-known methods, and experiments are made on the balancing of rotating masses.

424. Heat Power Engineering. R. C. Wiren.

Courses 3 and 5r, IV Year; 2 hrs. lectures per week, first term; 1 hr. lecture per week, second term.

A continuation of lecture subject 421. Properties of working substances; transitional stages from liquid to vapour to gas; calculations involving variable specific heats; insulation and heat transfer; power plant cycles; refrigeration cycles; steam turbines and condensers.

425. Internal Combustion and Aircraft Engines. E. A. Allcut.

Courses 3, 5r and 10, IV Year; 1 hr. lecture per week, both terms.

The difference between the efficiencies theoretically attainable and those actually achieved in internal combustion engines is examined in detail. The properties of the fuels used in gasoline and Diesel engines, the methods of testing them, and the various heat losses are described. Some consideration is also given to supercharging, detonation, cooling, and similar practical problems.

426. Heat Engine Laboratory. R. C. Wiren.

Courses 3 and 5r, IV Year; average $5\frac{1}{2}$ hrs. laboratory per week, both terms.

A continuation and extension of the work covered in the Third Year laboratory subject. Complete tests are made of heaters and of engines of various types, such as simple and compound steam engines, steam turbine, refrigerating machine, injectors, gas, Diesel, and gasoline engines, etc., and an analysis is made of the thermal cycles involved. A complete set of experiments is made on each machine and the result plotted to show clearly to the student the effect of various alterations in the adjustment of the engine on the resulting efficiency.

Two experimental stacks and three boilers enable results to be obtained on boiler efficiency and chimney draft.

427. Theory of Heat Engines. R. C. Wiren.

Courses 1 and 8, III Year; Department 2, IV Year; 1 hr. lecture per week, both terms.

Thermodynamics of gases and vapours as applied to heat engine cycles and exemplified by internal combustion engines, air compressors, steam engines and turbines, and refrigerating plants.

428. Heat Engine Laboratory. R. C. Wiren.

Course 1, III Year; eight 3-hr. laboratory periods, second term.

Course 6, III Year; average 1½ hrs. laboratory per week, second term.

Course 8, III Year; 1½ hrs. laboratory per week, second term.

Course 8a, III Year; 1½ hrs. laboratory per week, second term.

Course 2, IV Year; 1½ hrs. laboratory per week, first term.

Experiments with steam and internal combustion engines, compressed air, etc.

429. Heat Transfer and Refrigeration. E. A. Allcut.

Course 5r, IV Year; 2 hrs. lectures per week, both terms.

Refrigeration cycles and properties of refrigerants; flow of fluids and heat transfer; heat insulation; refrigerating machines and controls; air conditioning; cold storage; ice manufacture; industrial applications of refrigeration.

430. Heat Engine Practice. W. Bruce.

Course 8, III Year; 1 hr. lecture per week, both terms.

Heat engine practice as exemplified by steam and internal combustion engines and turbines, air compressors, etc.

HYDRAULICS AND HYDROSTATICS

440. Hydraulics. G. R. Lord, L. E. Jones.

Courses 1, 3, 6, 7, and 11, III Year; 2 hrs. lectures per week, both terms.

Course 2, III Year; Course 8a, IV Year; 2 hrs. lectures per week, first term.

Attention is given to the development and discussion of formulæ relating to the flow of water in pipes, the measurement of discharge by various methods, such as orifices and weirs, the conditions of flow obtaining in open channels, artificial and natural, and in pipes flowing partially full, together with other kindred subjects.

The object of this subject is to provide the student with a good working knowledge of the fundamental principles of hydraulics, such as are useful in practical work and are necessary to the intelligent investigation of more advanced problems, and such as the design of water supply, sewerage and irrigation systems, and water power plants.

441. Hydraulic Laboratory. G. R. Lord, L. E. Jones.

Courses 1, 3, 7, and 11, III Year; one 3 hr. laboratory period per week, second term.

Courses 2 and 6, III Year; six 3 hr. laboratory periods, first term.

The work in this subject is intended to illustrate the lecture subjects given in hydraulics and to give the student some working acquaintance with the formulæ derived. Experiments are made to determine the coefficients for orifices of the various types used in practice and for weirs. The results of these experiments are used in measuring the discharge in subsequent experiments on meters and for the determination of hydraulic resistances in various cases of flow in pipes. The complete subject illustrates very fully the application of the lectures to actual cases.

442. Hydraulics. G. R. Lord.

Course 3, IV Year; 1 hr. lecture per week, both terms.

The various problems of unsteady flow such as occur in power plants, penstocks, etc. Much of the work is done by the process of arithmetic integration, and the lecture work is supplemented by problems solved by the students in the work rooms, the time for which is included in subject 444. Surges, water hammer, stream flow data, etc., are discussed.

The problems of collection of water for power purposes, use of the mass curve, rainfall and evaporation, etc., are also treated as far as possible. The flow of gases is also discussed.

443. Hydraulics. G. R. Lord.

Course 3, IV Year; 1 hr. lecture per week, first term; 2 hrs. lectures per week, second term.

Theory and design of turbines, pumps, fans, propellers, and other hydraulic machinery, as well as the application of hydraulic systems to aircraft and machine tools. The selection of turbines, pumps, and fans is dealt with, as well as problems related to the mechanical parts of hydraulic power plants. Cavitation in connection with pumps, turbines, and propellers is fully discussed.

444. Hydraulic Laboratory. G. R. Lord, L. E. Jones.

Courses 1e and 3, IV Year; average of 5½ hrs. laboratory per week in 3 and 2 hr. periods, both terms.

Experimental work on turbines of various types, and centrifugal and turbine pumps and other similar devices. This experimental work is arranged to illustrate the lectures on turbine and pump design. The experiments are made on hydraulic models and on two large turbine pumps used in the laboratory supply, as well as on apparatus specially designed for instruction. Various methods of measuring water-power and the efficiency of machines are also given. A list of the equipment now available and which is used in this subject, is given in Section XII.

445. Hydraulics. G. R. Lord.

Course 1, IV Year; 1 hr. lecture per week, both terms.

General hydraulic problems such as surges in pipe lines, water hammer, flow in open channels and backwater, mass curves and a general discussion of pumps.

446. Hydraulic Laboratory. G. R. Lord, L. E. Jones.

Course 1, IV Year; one 3 hr. laboratory period per week, first term.

Supplementing subject 445.

Experiments are carried out on turbines and pumps, current meter and Pitot tube rating, etc. Problems are worked out in the class room and mass curves, etc., as plotted.

447. Elementary Hydraulics. L. E. Jones.

Courses 1 and 7, II Year; 1 hr. lecture per week, second term.

Courses 3, 6, 8, 8a, and 11, II Year; 1 hr. lecture per week, first term.

Fluid pressure and its application in the design of engineering structures. Forces acting on the bottoms and ends of tanks; pressures on pipes, gates and walls; stability of dams; laws governing the equilibrium of floating bodies.

448. Mechanical and Thermal Measurements. G. R. Lord, S. E. Wolfe, L. E. Jones.

Courses 2, 3, 6, 7, 8, 8a, and 9, I Year; 2 hrs. lectures per week, second term.

A subject to prepare the student for work in hydraulics, thermodynamics, machine design, and analogous subjects.

449. Properties of Fluids. L. E. Jones.

Course 3, II Year; 2 hrs. lectures per week, first term.

A continuation of subject 448.

451. Hydraulics. G. R. Lord.

Course 2, IV Year; 1 hr. lecture per week, second term.

Pumping and drainage problems connected with the operation of mines and mining properties.

452. Aircraft Hydraulics. G. R. Lord.

Course 10, IV Year; 1 hr. lecture per week, first term.

A discussion of the numerous aircraft services that require remotely controlled power operation which can best be performed hydraulically. The basic principles underlying the design of aircraft hydraulic systems are considered in order that the student may understand present systems and master sufficient of the fundamental theory to enable him to follow future design.

Text book: Aircraft Hydraulics—Adams.

MACHINERY

461. Mechanical Engineering. W. G. McIntosh.

Course 3, II Year; 2 hrs. lectures per week, second term.

Materials of design and production methods. In addition, standards, tolerances, limits, fits, and mechanical drafting room practice will be explained.

Text books: Drawings and Drafting Room Practice. Manufacturing Processes—Begeman.

462. Elementary Machine Design. W. G. McIntosh.

Courses 6, 7, 8 and 8a, II Year; 2 hrs. lectures per week, second term.

A preparatory subject intended to familiarize the student with the different shop methods and processes, casting, forging, machining, etc., used in the production of machine parts, to enable him to make proper provision in the design of such parts to facilitate their production.

In addition, the various standards, machine and pipe threads, tapers, pipe fittings, etc., are described and mechanical drafting room practice explained. Tolerances, limits, fits and gauges are discussed.

Text book: Factory Equipment—Roe and Lytle. Drawings and Drafting Room Practice.

463. Machinery. D. D. Panabaker.

Course 1, III Year; 2 hrs. lectures per week, first term.

Design and selection of various machine elements, with particular reference to their application to bridges, shovels and other machinery affecting civil engineers.

Text book: Design of Machine Elements—Faires.

464. Machine Design Laboratory. W. G. McIntosh, D. D. Panabaker, I. W. Smith.

Course 1, III Year; 3 hrs. laboratory per week, first term.

The work in the laboratory and the drafting problems assigned will illustrate the lecture subject.

465. Theory of Machines I. I. W. Smith.

Courses 3 and 10, II Year; 2 hrs. lectures per week, both terms.

A study of basic machine components, including the standard linkages, cams, gearing, and gear trains, with reference to practical applications. Methods for analysis of velocity, acceleration, and force distribution in machines. Effects of friction and determination of efficiency. The plotting and use of crank effort and torque diagrams.

Reference books: Theory of Machines—Angus. Mechanism—Prageman. Mechanism and Kinematics of Machines—Steeds.

466. Theory of Machines II. I. W. Smith.

Course 3, III Year; 2 hrs. lectures per week, first term.

A consideration of inertia forces and their effect in machines. Fluctuation of machine speed and its control by flywheels and governors. Balancing of rotating parts, engine balance, elementary vibration.

A working knowledge of velocity, acceleration, and force analysis is essential in this course.

Reference books: Theory of Machines—Angus. Theory of Machines—Bevan. Mechanics of Machinery—Ham and Crane.

467. Machine Design. W. G. McIntosh.

Courses 3, 10, and 11, III Year; 2 hrs. lectures per week, both terms.

The design of various machine elements, including screw threads for fastening and power transmission, shafting, bearings (journal, thrust, ball, and roller) belts, pulleys, spur gears, flywheels, keys, clutches, etc.

Text book: Design of Machine Elements—Faires.

468. Machine Design and Mechanics of Machinery Laboratory. W. G. McIntosh, D. D. Panabaker, I. W. Smith.

Course 3, III Year; an average of 7½ hrs. laboratory per week, both terms.

Course 7, III Year; 3 hrs. laboratory per week, second term.

Course 10, III Year; 6 hrs. laboratory per week, both terms.

Course 11, III Year; 3 hrs. laboratory per week, both terms.

The work in the laboratory will consist of analytical and graphical solution of problems illustrating the principles involved in the lecture course in Mechanics of Machinery, and the design of machine parts covered in the lecture course in Machine Design. The object of the work on the drafting board is with a view to developing the students' judgment and sense of proportions in design and the application of drafting room standards.

469. Machine Design. W. G. McIntosh, R. T. Waines, D. J. Parrish.

Courses 2, 6, 8 and 8a, IV Year; 1 hr. lecture per week, both terms.

The design of various machine elements, particularly those likely to be met with in chemical and metallurgical plants, and in mining work.

Text book: Design of Machine Elements—Faires.

470. Machine Design Laboratory. W. G. McIntosh, D. D. Panabaker, I. W. Smith.

Courses 2, 6, 8 and 8a, IV Year; 3 hrs. laboratory per week, second term.

Problems worked out in the laboratory, designed to give the student training in the general lay-out of shafting and plant machinery, as well as in the design of simple parts for chemical and metallurgical apparatus, and mine machinery.

471. Elementary Machine Design. D. D. Panabaker.

Course 5, II Year; 1 hr. lecture per week, both terms.

Some acquaintance with the selection of materials and their use in the design and construction of machinery. Machine parts are analysed as to suitable materials, production methods, and the nature and magnitude of the stresses encountered.

Text book: Design of Machine Elements—Faires.

472. Elementary Machine Design Laboratory. W. G. McIntosh, D. D. Panabaker, I. W. Smith.

Course 5, II Year; 3 hrs. laboratory per week, both terms.

The work in the laboratory will consist of the analytical solution of problems, illustrating the principles involved in the lecture course, and the standard practice in making assembly and detail machine drawings.

473. Machine Design. W. G. McIntosh.

Course 3, IV Year; 2 hrs. lectures per week, both terms.

Design of machine frames, hooks, hoisting equipment, crank shafts, gears of various kinds (helical, herringbone, bevel, screw, worm), springs, clutches, brakes, thin and thick wall vessels. An introduction will be given to the study of dynamic problems connected with the motor car, Diesel engine, and other high speed machinery.

Text book: Design of Machine Elements—Faires.

474. Advanced Machine Design Laboratory. W. G. McIntosh, D. D. Panabaker, I. W. Smith.

Course 3, IV Year; 5 hrs. laboratory per week, first term; 6 hrs. laboratory per week, second term.

Work in the laboratory devoted to the design of complete machines, with the object of giving the student practice not only in the design of various details, but also in working the various elements into a machine of smooth and harmonious design. The machines chosen as examples for design involve as many new machine elements as possible, in order to broaden the training of the student.

The work in the laboratory also involves special shafting problems, including graphical solutions, critical speeds, and multiple supports.

475. Machine Design. D. D. Panabaker.

Course 7, III Year; 2 hrs. lectures per week, both terms.

Principles of stress analysis and the design of various machine elements, including screw threads, shafting, bearings, belts, gears, flywheels, etc.; also an introduction to work on speed fluctuation and balancing.

Text book: Design of Machine Elements—Faires.

476. Manufacturing Processes.

Courses 11, IV Year; 2 hrs. lectures per week, both terms.

A study of metal casting, mechanical working, welding, heat treating, plastics and ply-wood moulding, finishes, machining, and mass production engineering.

477. Manufacturing Processes Laboratory.

Course 11, IV Year; 3 hrs. laboratory per week, both terms.

Design of castings and forgings and the selection of suitable manufacturing processes from raw material through forming, machining, mass production tooling, gauging, and finishing.

MATHEMATICS

490. Calculus. I. R. Pounder, J. D. Burk, Miss M. E. G. Waddell, B. Noonan.

Courses 1, 2, 3, 4, 6, 7, 8, 8a and 9, I Year; 2 hrs. lectures per week, both terms.

Course 7, I Year, one 3 hr. period per week, both terms, for problems.

Derivation of the fundamental formulæ of the differential and integral calculus, with early applications to simple problems concerning graphs, areas, volumes, lengths, centres of gravity, and moments of inertia. Problems are dealt with in the drafting room as outlined in subjects 275, 276, 277, 278, 279, 280, 281, 282, and 283. For Course 7, an additional period of three hrs. per week is provided for problems and exercises, conducted by the Department of Mathematics.

491. Calculus. S. Beatty, D. B. DeLury, Miss M. E. G. Waddell, A. Schild.

Courses 1, 3, 6, 7, 8, and 11, II Year; 2 hrs. lectures per week, both terms.

Course 7, II Year; one 3 hr. period per week, both terms, for problems.

Continuation of subject 490. The elementary theory reviewed and extended. Special attention to applications with problems in

engineering mostly in view. Introduction to the study of simple differential equations. Problems are dealt with in the drafting room as outlined in subjects 284, 285, 286, 287, 288, and 289. For Course 7, an additional period of three hrs. per week is provided for problems and exercises, conducted by the Department of Mathematics.

492. Analytical Geometry. I. R. Pounder, J. D. Burk, Miss M. E. G. Waddell, L. S. Sinclair.

Courses 1, 2, 3, 4, 6, 7, 8, 8a and 9, I Year; 1 hr. lecture per week, first term, 2 hrs. per week, second term.

The work in Elementary Analytical Geometry covers the more familiar propositions in connection with the straight line, circle, parabola, ellipse, and hyperbola. The subject is treated to illustrate the general methods of analytical geometry. In addition problems are dealt with in the drafting room as outlined in subjects 275, 276, 277, 278, 279, 280, 281, 282, and 283. A part of the problem time for Course 7 listed under subject 490 is devoted to problems in analytical geometry.

493. Spherical Trigonometry. J. W. Melson.

Course 1, II Year; 1 hr. lecture per week, first term.

The derivation of formulæ and their application to the solution of triangles and to practical problems.

Text books: Spherical Trigonometry—Todhunter and Leatham Printed Lecture Notes—J. W. Melson.

494. Least Squares. J. W. Melson.

Course 1, II Year; 1 hr. lecture per week, second term.

The general principles of probability, the law of error, direct measurements of equal and different weights; mean square and probable errors; indirect measurements; conditioned observations; applications to empirical constants and formulæ, etc.

Text books. Least Squares—Merriman. Printed Lecture Notes —J. W. Melson.

502. Algebra and Calculus. R. Brauer, J. A. Jenkins, R. Steinberg.

Courses 5 and 10, I Year; $3\frac{1}{2}$ hrs. lectures per week, both terms.

Polynomials and rational functions, elementary theory of equations, inequalities, determinants, limits, summation of series, binomial, exponential, and logarithmic series, expansions of the circular and hyperbolic functions and their inverses, the methods and operations of the Calculus considered intuitively and illustrated by applications, and elementary differential equations.

Text books. Introduction to the Calculus—Osgood. Introduction to the Calculus—Beatty and Jenkins.

503. Analytical Geometry of the Plane. R. Brauer, J. A. Jenkins, R. Steinberg.

Courses 5 and 10, I Year; $1\frac{1}{2}$ hrs. lectures per week, both terms.

Cartesian and polar coordinates, transformation of coordinates, straight lines and curves of the second degree, projective properties of conics, the principle of duality, higher plane curves.

Text book: Analytical Geometry—Nowlan.

504. Differential Calculus. D. A. F. Robinson.

Courses 5 and 10, II Year; 3 hrs. lectures per week, both terms.

Differentiation, Taylor's theorem and series for functions of one or more variables, families of curves and surfaces and their differential equations, Jacobians, geometrical and mechanical applications.

Text books: Introduction to the Calculus—Osgood. Introduction to the Calculus—Beatty and Jenkins.

505. Integral Calculus and Differential Equations. W. J. Webber.

Courses 5 and 10, II Year; 3 hrs. lectures per week, both terms.

The indefinite integral, integration of rational and other special functions, the definite integral, differentiation with respect to a parameter, multiple integration, Fourier's series, geometrical and mechanical applications, approximate integration, introduction to ordinary differential equations.

Text books: Introduction to the Calculus—Osgood. Intreduction to the Calculus—Beatty and Jenkins.

506. Analytical Geometry of Space. J. A. Jenkins.

Courses 5 and 10, II Year; 1 hr. lecture per week, both terms.

Cartesian and other systems of point coordinates, curves and surfaces and their equations in parametric or non-parametric form, data fixing planes, lines, conics, and quadrics, generating lines and circular spectrons of quadrics, classification of quadrics, tangent cones to quadrics, metric and projective properties of quadrics, families of quadrics, ruled surfaces and surfaces of revolution.

Text book: Coordinate Geometry—Eisenhart.

507. Differential Equations. Miss C. C. Krieger.

Courses 1, 5, and 10, III Year; 1 hr. lecture per week, both terms.

Courses 1, 5, and 10, III Year; 1 hr. problem work per week, both terms.

First order equations solvable by quadratures, depression of the order, the linear equation, systems of linear equations with constant coefficients, first order partial equations in two variables, total differential equations, particular equations of the second order.

Text books: Differential Equations — Piaggio. Differential Equations—Cohen.

508. Theory of Functions. Miss C. C. Krieger.
Courses 5 and 10, III Year; 1 hr. lecture and 1 hr. problem work per week, both terms.
Green's and Stokes's Theorems, conformal mapping of one plane region on another, the complex variable, analytical functions, Cauchy's Theorem and Integral Formula, Poisson's Formula, Taylor's and Laurent's series.
Text book: Theory of Functions—Rothe, Ollendorff, and Pohlhausen.

MATHEMATICS, APPLIED

520. Theoretical Mechanics. A. Weinstein.
Course 5, III Year; 1 hr. lecture and 1 hr. problem work per week, both terms.
A systematic application of mathematical methods to the solution of problems in mechanics, with emphasis on general principles. The problems deal chiefly with the plane motion of particles and rigid bodies. Lagrange's equations are introduced.
Text book: Principles of Mechanics—Synge and Griffith.

521. Differential Equations of Mathematical Physics. A. F. Stevenson.
Course 5, IV Year; 2 hrs. lectures per week, both terms.
The underlying theory and important particular equations, including eigenvalues and eigenfunctions, Fourier series, spherical and cylindrical harmonics, vibration of strings, membranes, and rods, sound waves, water waves, equation of heat conduction.

522. Theory of Elasticity. A. Weinstein.
Course 10, IV Year; 2 hrs. lectures per week, first term.
General analysis of strain and stress, stress-strain relations, equations of equilibrium, bending of beams, shell and pipe with internal pressure, torsion problems.

523. Theoretical Hydrodynamics. A. Weinstein.
Course 10, IV Year; 1 hr. lecture per week, both terms.
The fundamental theory of hydrodynamics with special reference to aerodynamics, including irrotational motion, aerofoil theory, boundary layer theory.
Text book: Aerofoil and Airscrew Theory—Glauert.

METALLURGY

530. Metallurgy. L. M. Pidgeon.
Course 8, II Year; Courses 2 and 9, III Year; 1 hr. lecture per week, first term.
An introductory course describing the theory and practice of metallurgical operations.

531. Fuels and Combustion. J. E. Toomer.
Courses 8 and 8a, II Year; 1 hr. lecture per week, both terms.
Fuels, their use, preparation, calorific value, and combustion.

533. Physical Metallurgy. J. A. Newcombe.
Courses 3, 5, 7, 8a, and 11, III Year; 2 hrs. lectures per week, second term.
General physical metallurgy, including the common engineering alloys.

534. Metallurgy. L. M. Pidgeon.
Course 8, III Year; 2 hrs. lectures per week, first term; 1 hr. lecture per week, second term.
A general discussion of the fundamental principles of metallurgy, including the production of the more important metals. Metallurgical problems are included in this course.

535. Metallurgy Laboratory. J. E. Toomer.
Course 8, III Year; 6 hrs. continuous laboratory per week, first term; 3 hrs. laboratory per week, second term.
Experiments in roasting, smelting, leaching, and retorting.

536. Physical Metallurgy. J. A. Newcombe.
Course 8, III Year; 2 hrs. lectures per week, both terms.
The physical metallurgy of the common alloys; equilibrium diagrams. Pyrometry.

537. Metallography Laboratory. J. A. Newcombe.
Course 8, III Year; 3 hrs. laboratory per week, both terms.
The use of the microscope. The preparation of alloys. Pyrometry.

538. Metallurgy. L. M. Pidgeon.
Course 2, IV Year; 1 hr. lecture per week, both terms.
Calculations necessary to understand metallurgical processes.

539. Metallurgy Laboratory. J. E. Toomer.
Course 2, IV Year; 3 hrs. laboratory per week, second term.
Similar to subject 535.

540. Metallurgy Problems. L. M. Pidgeon.
Course 8, IV Year; 2 hrs. lectures per week, both terms.
Problems of chemical reactions, thermochemistry, electrolysis, vapor pressure, transmission of heat, etc.

541. Metallurgy Laboratory. J. E. Toomer.
Course 8, IV Year; 6 hrs. continuous laboratory per week, first term; 2 hrs. laboratory per week, second term.
Metallurgical analyses of ores, furnace products, and alloys.

542. Metallurgy. L. M. Pidgeon.

Course 8, IV Year; 1 hr. lecture per week, both terms.

Critical reading and discussion of papers, describing metallurgical processes or dealing with plant arrangement and construction.

543. Physical Metallurgy. J. A. Newcombe.

Courses 6m and 8, IV Year; 2 hrs. lectures per week, both terms.

A continuation of subject 536, dealing more particularly with the ferrous alloys. Part of the lectures consist of discussions of photo-micrographs.

544. Metallography Laboratory. J. A. Newcombe.

Course 8, IV Year; 3 hrs. laboratory per week, both terms.

Specimens of the common alloys are prepared, microscopically examined, and photographed.

545. Physical Metallurgy. J. A. Newcombe, W. L. Sagar.

Course 8, IV Year; 3 hrs. laboratory per week, first term.

The introductory part of this subject is intended to give some familiarity with the experimental study of the elastic and physical properties of iron and steel, and in the use of testing machines and instruments of precision designed for that purpose. Following this, carbon and alloy steels are given different heat treatments. The structures developed are examined and photographed, mechanical tests are made and findings correlated.

546. Physical Metallurgy. J. A. Newcombe.

Courses 1, 2, 6, and 9, III Year; 1 hr. lecture per week, second term.

The mechanical properties and heat treatment of steel; cast-iron.

547. Heat Treatment of Iron and Steel. J. A. Newcombe.

Courses 3 and 11, IV Year; 1 hr. lecture per week, both terms.

The principles underlying the heat treatment and mechanical treatment of carbon and alloy steels. Cast iron.

548. Heat Treatment of Iron and Steel Laboratory. J. A. Newcombe.

Courses 3 and 11, IV Year; 1½ hrs. laboratory per week, second term.

Preparation of specimens of steels and irons, and examining them microscopically.

549. Physical Metallurgy Laboratory. J. A. Newcombe.

Courses 2 and 9, III Year; 1 hr. laboratory per week, second term.

Specimens of the common alloys are prepared and microscopical examined.

550. Metallurgical Theory. J. W. Bain.

Course 8, IV Year; 1 hr. lecture per week, both terms.

A study of equilibria at high temperatures in production metallurgy.

551. Aircraft Materials. T. R. Loudon, J. A. Newcombe, L. M. Pidgeon.
Course 10, IV Year; 1 hr. lecture per week, both terms.
Alloys of magnesium and aluminum, high strength steels, castings and forgings, together with wood and plastics, as used in aircraft construction.

CERAMICS AND NON-METALLIC MINERALS

560. Non-Metallic Minerals. R. J. Montgomery.
Course 8a, III Year; 4 hrs. lectures per week, first term; 2 hrs. lectures per week, second term.
Industrial classification, properties, and utilization of non-metallic minerals. Ceramic plant practice is covered in some detail in the second term.

561. Non-Metallic Minerals Laboratory. R. J. Montgomery.
Course 8a, III Year; 7 hrs. laboratory per week, first term; 8½ hrs. laboratory per week, second term.
The physical properties and thermal characteristics of non-metallic minerals are studied from an industrial standpoint.

562. Ceramics. R. J. Montgomery.
Course 8a, III Year; 2 hrs. lectures per week, second term.
The composition of clear and coloured glazes.

563. Ceramic Calculations. J. E. Toomer.
Course 8a, IV Year; 1 hr. lecture per week, first term.
Lectures and problems on calculations necessary for the compounding of ceramic bodies and glazes.

564. Ceramics Laboratory. J. E. Toomer.
Course 8a, III Year; 10½ hrs. laboratory per week, first term; 3 hrs. laboratory per week, second term.
Practice in the analysis of non-metallic minerals.

565. Refractories and Ceramic Bodies. R. J. Montgomery.
Course 8a, IV Year; 1 hr. lecture per week, first term; 2 hrs. lectures per week, second term.
Composition of bodies made by using non-metallic minerals, with special reference to refractories, whiteware, and porcelain.

566. Glass and Enamels. R. J. Montgomery.
Course 8a, IV Year; 1 hr. lecture per week, both terms.
Composition and manufacture of glass and iron enamels.

568. Industrial Minerals Laboratory. R. J. Montgomery.
Course 8a, IV Year; 9 hrs. laboratory per week, first term; 6 hrs. laboratory per week, second term.
Advanced work on the compounding and testing of non-metallic mineral products.

569. Building Materials; Ceramic. R. J. Montgomery.

Course 4, IV Year; 1 hr. lecture per week, both terms.

Composition, manufacture, properties, and use of ceramic building materials.

570. Glass Technology. R. J. Montgomery.

Course 6c, IV Year; 2 hrs. lectures per week, first term; 1 hr. lecture per week, second term.

A consideration of chemical reactions at high temperature, based upon the composition and properties of various glasses.

571. Glass Technology Laboratory. R. J. Montgomery.

Course 6c, IV Year; 6 hrs. laboratory per week, first term; 19 hrs. laboratory per week, second term.

Based upon subject 570.

MINERALOGY

580. Elementary Mineralogy. E. W. Nuffield.

Courses 2 and 9, I Year; 2 hrs. lectures per week, second term.

An introductory course in general and descriptive mineralogy.

Text book: Dana's Manual of Mineralogy—Hurlbut.

581. Introductory Mineralogy. V. B. Meen.

Courses 6, 8, and 8a, I Year; 2 hrs. lectures and laboratory per week, second term.

A brief study of the common minerals.

Reference book: Dana's Manual of Mineralogy—Hurlbut.

582. Elementary Petrography. V. B. Meen.

Course 1a, III Year; 2 hrs. lectures and laboratory per week, first term.

A brief study of rock-forming minerals and rocks.

Text book: Handbook of Rocks—Kemp-Grout.

583. Elementary Mineralogy Laboratory. R. M. Thompson.

Courses 2 and 9, I Year; 1 hr. laboratory per week, second term.

A practical course to accompany subject 580.

Reference book: Dana's Manual of Mineralogy—Hurlbut.

587. Elementary Petrography. V. B. Meen.

Courses 2 and 9, II Year; Course 5g, III Year; 1 hr. lecture and laboratory per week, both terms.

A brief study of rock-forming minerals and rocks.

Text book: Handbook of Rocks—Kemp-Grout.

589. Blowpipe Analysis. R. M. Thompson.

Courses 2 and 9, II Year; 2 hrs. laboratory per week, second term.

Determination of minerals by means of blowpipe and physical properties.

Reference book: Dana's Manual of Mineralogy—Hurlbut.

590. Advanced Petrography. V. B. Meen.

Course 9, III Year; Course 5g, IV Year; 1 hr. lecture per week, both terms.

Microscopic characters of the rock-forming minerals in thin sections, and description and classification of rocks, continuing subject 587.

Text books: Optical Mineralogy—Rogers and Kerr. Petrology for Students—Harker.

591. Advanced Petrography Laboratory. V. B. Meen.

Course 9, III Year; Course 5g, IV Year; 2 hrs. laboratory per week, both terms.

Microscopic petrography to accompany subject 590.

Text books: Optical Mineralogy—Rogers and Kerr. Petrology for Students—Harker.

592. Advanced Optical Mineralogy Laboratory. M. A. Peacock.

Courses 8a and 9, IV Year; 2 hrs. laboratory per week, both terms.

Determination of the non-opaque minerals by the immersion method.

Reference books: Optical Crystallography—Wahlstrom. The Microscopic Determination of the Non-opaque Minerals—Larsen and Berman.

593. Mineralography Laboratory. R. M. Thompson.

Course 9, IV Year; 2 hrs. laboratory per week, both terms.

A study of the common ore minerals in polished sections.

Reference book: Microscopic Determination of the Ore Minerals —Short.

594. Morphological Crystallography. M. A. Peacock.

Course 5s, IV Year; 1 hr. lecture per week, both terms.

A course on the thirty-two crystal classes, with reference to natural and artificial crystals.

Text book: The Form and Properties of Crystals—Dale.

595. General Petrography. V. B. Meen.

Course 2, III Year; 1 hr. lecture per week, second term.

Continuation of subject 587.

Text books: Optical Mineralogy—Rogers and Kerr. Petrology for Students—Harker.

596. General Petrography Laboratory. V. B. Meen.

Course 2, III Year; 2 hrs. laboratory per week, second term.

Microscopic examination of rock-forming minerals and rocks.

Text books: Optical Mineralogy—Rogers and Kerr. Petrology for Students—Harker.

597. Elementary Optical Mineralogy. V. B. Meen.
Courses 2 and 9, II Year; Courses 5g and 8a, III Year; 1 hr. lecture and laboratory per week, second term.
A preparation for the study of microscopic petrography.
Text book: Optical Mineralogy—Rogers and Kerr.

598. Elementary Mineralogy. E. W. Nuffield.
Course 5g, III Year; 2 hrs. lectures per week, first term.
An introductory course on general and descriptive mineralogy.
Text book: Dana's Manual of Mineralogy—Hurlbut.

599. Elementary Mineralogy Laboratory. E. W. Nuffield.
Course 5g, III Year; 1 hr. laboratory per week, first term.
A practical course to accompany subject 598.

MODERN LANGUAGES

610. English. W. J. T. Wright.
All courses, I Year; 1 hr. lecture per week, both terms.
The expression of ideas and the compilation and writing of engineering reports and letters; technical exposition; the necessity of accurate expression in professional writing; the value of reading.

613. German. T. Hedman.
Course 6, II Year; 1 hr. lecture per week, both terms.
A tutorial class for those who cannot present Junior Matriculation certificates in German.

614. German. T. Hedman.
Course 6, III Year; 1 hr. lecture per week, both terms.
An advanced course in scientific German.

615. German. T. Hedman.
Course 6, IV Year; 1 hr. lecture per week, both terms.
An advanced course in scientific German. Translation of scientific articles and treatises.

PHYSICAL TRAINING

640. Physical Training.
All courses, I and II Years.
The requirements for Physical Training are outlined in Section XIV.
Military Training in the C.O.T.C. constitutes an option in Physical Training (see page 190).

PHYSICS

650. Properties of Matter; Mechanics and Heat. John Satterly.
Courses 5 and 10, I Year; 4 hrs. lectures, per week, both terms.
In addition to the work in the divisions indicated in the title, the subject also includes lectures and problems on calculations for

science students involving curve plotting and curve fitting, and the use of the elementary calculus and statistics.

Reference books: Dynamics—Duncan and Starling. Mechanics of Fluids — Barton. Properties of Matter — Wagstaff. Heat — Stewart and Satterly (ed. Archer). Mathematical and Physical Tables—Clark. Calculus Made Easy—Thompson. Theory of Measurements—Tuttle and Satterly. Practical Geometry—Good.

651. Properties of Matter; Mechanics and Heat Laboratory. John Satterly.

Courses 5 and 10, I Year; 3 hrs. laboratory per week, both terms. Supplementary to subject 650.

652. Elementary Magnetism and Electricity. D. S. Ainslie.

Course 5, II Year; 1 hr. lecture per week, first term; 2 hrs. lectures per week, second term.

Fundamental theory of magnetism and electricity, including the introduction of electron theory and alternating currents.

Reference books: Advanced Text-book of Magnetism and Electricity—Hutchinson. Electricity and Magnetism—Starling.

653. Elementary Light. M. F. Crawford.

Course 5, II Year; 1 hr. lecture per week, both terms.

Fundamental theory of light, including treatment of interference, diffraction, polarized light, and the introduction of geometrical optics.

Reference books: Light for Students—Edser. Introduction to Physical Optics—Robertson. Optical Measuring Instruments—Martin.

654. Acoustics.

Course 5, II Year; 1 hr. lecture per week, first term.

Fundamental theory of acoustics, including elementary treatment of architectural acoustics.

655. Physics Laboratory (Magnetism and Electricity, Light and Acoustics).

Course 5, II Year; 3 hrs. laboratory per week, first term; 6 hrs. laboratory per week, second term.

Work carried out under the direction of the staff in Physics, covering lectures dealt with in subjects 652, 653 and 654.

656. Mathematical Operations Applied to Physics.

Course 5, III Year; 1 hr. lecture per week, both terms.

The application of vector analysis to physical problems, and an elementary treatment of Fourier Series, Spherical Harmonics, Bessel functions, etc.

657. Properties of Matter. John Satterly.

Course 5, III Year; 2 hrs. lectures per week, both terms.

Advanced work on properties of matter, dealing with gravitation, elasticity, viscosity, surface tension, and kinetic theory of gases.

Reference books: Properties of Matter—Poynting and Thomson. General Properties of Matter—Newman and Searle. Applied Mathematics—Perry. Experimental Physics—Searle. Practical Physics—Watson. The Mechanical Properties of Fluids—Drysdale and others.

658. Heat. John Satterly.

Course 10, II Year; 1 hr. lecture per week, first term.

Course 5, III Year; 1 hr. lecture per week, both terms.

Thermometry and pyrometry; absolute scale of temperature, mechanical equivalent of heat, kinetic theory of gases, equations of state, low temperature work, specific heats, vaporization, fusion, expansion, transfer of heat by conduction and convection; radiation and radiation pyrometry, the second law of thermodynamics and its simple applications.

Reference books: Heat and Thermodynamics — Roberts. Methods of Measuring Temperature—E. Griffiths. A Textbook on Heat. Parts I and II—Allen and Maxwell.

659. Physical Laboratory.

Course 10, II Year; 3 hrs. laboratory per week, first term.

Course 5, III Year; 3 hrs. laboratory per week, both terms.

Experiments illustrating the principles involved in the two preceding subjects.

660. Optics. R. Richmond.

Courses 5c, 5i, and 5s, III Year; 1 hr. lecture per week, second term.

Geometrical Optics. The theory of paraxial rays and aberrations in optical systems.

Reference books: Applied Optics and Optical Design, Part One —Conrady. The Principles of Optics—Hardy and Perrin. Fundamentals of Optical Engineering—Jacobs.

661. Optics. R. Richmond.

Courses 5c, 5i, and 5s, III Year; 3 hrs. laboratory per week second term.

Supplementary to subject 660.

662. Hydrodynamics.

Course 10, III Year; 1 hr. lecture per week, both terms.

Hydrodynamics of a perfect fluid, with applications to motion in liquids and gases. Reference will be made to some of the simpler cases of viscous flow. The course will be illustrated by experiments.

Text books: Treatise on Hydromechanics—Ramsay. Aerofoil and Airscrew Theory—Glauert. The Physics of Solids and Fluids—Ewald, Poschl and Prandtl. Hydro and Aeromechanics—Prandtl-Tietjens.

663. Introduction to Atomic and Molecular Physics. Miss E. J. Allin.

Courses 5c and 5s, IV Year; 1 hr. lecture per week, both terms.

Kinetic theory of gases, electrical discharge through gases, the electron, elementary X-rays and crystal structure, ionization, the development of radioactivity and its use in the physical and geological sciences.

Text book: The 'Particles' of Modern Physics—Stranathan.

Reference books: The Atom—Andrade. Radioactivity—Rutherford, Chadwick and Ellis. Heat—Poynting and Thomson. Kinetic Theory of Gases—Jeans.

664. Advanced Acoustics.

Courses 5c, 5s and 5i, IV Year; 1 hr. lecture per week, first term.

Properties and transmissions of acoustical waves. Analogies in alternating current theory and other fields in physics. Sound filters.

665. Physical Laboratory. H. J. C. Ireton.

Course 5c, IV Year; 3 hrs. laboratory per week, both terms.

Course 5s, IV Year; 9 hrs. laboratory per week, both terms.

Accompanying the lecture subjects 663, 664, 666, 667, 668, and 669.

666. Advanced Optics. M. F. Crawford.

Course 5s, IV Year; 1 hr. lecture per week, both terms.

Principles and applications of various types of spectroscopic instruments. Interference, diffraction, and polarisation; refractometers and polarimeters.

Text books: Applied Optics—Martin. Course d'Optique—Bruhat. The Diffraction of Light, X-Rays, Etc.—Meyer. Applied Optics and Optical Design—Conrady.

667. Series Spectra. H. J. C. Ireton.

Course 5s, IV Year; 1 hr. lecture per week, second term.

Early developments in atomic spectroscopy, the origin of spectral lines, and their empirical classification into series. Application of the derived formulæ to hydrogen, helium, and the alkali metals is given.

Reference book: Introduction to Modern Physics—Richtmyer and Kennard.

668. Elementary Quantum Theory. Miss E. J. Allin.

Course 5s, IV Year; 1 hr. lecture per week, first term.

The fundamental principles of the quantum theory developed from a historical and experimental standpoint, radiation formulæ, photoelectric effect, Compton effect, specific heats.

669. Analysis of Materials by Spectrographic and X-Ray Methods.

Course 5s, IV Year; 1 hr. lecture per week, both terms.

Qualitative and quantitative methods of spectro-chemical analysis of materials. The physical properties of X-rays, their production and applications to crystal structure.

Reference books: Applied X-Rays—Clark. Chemical Spectroscopy—Brode. Optical Methods of Chemical Analysis—Gibb.

670. Exploration Geophysics. A. A. Brant, N. B. Keevil, J. H. Hodgson.

Courses 5g and 9, IV Year; 2 hrs. lectures per week, both terms.

Physical principles underlying geophysical methods used in locating mineral deposits. Particular attention is given to magnetic, electrical, electromagnetic, gravitational, seismological, thermometric, and radioactive methods.

Reference books: Geophysical Exploration—Heiland. Exploration Geophysics—Jakosky. Imperial Geophysical Exp. Survey, Broughton—Edge and Laby. Applied Geophysics—Eve and Keys.

671. Geophysics. A. A. Brant, N. B. Keevil, J. H. Hodgson.

Course 5g, IV Year; 9 hrs. laboratory per week, both terms.

Course 9, IV Year; 6 hrs. laboratory per week, both terms.

A laboratory course accompanying subject 670 to illustrate the physical principles and measurements involved in geophysical field work, the mapping and interpretation of survey data.

672. Physics of the Earth. A. A. Brant, N. B. Keevil, J. H. Hodgson.

Course 5g, IV Year; 2 hrs. lectures per week, both terms.

Basic considerations of gravitation; the figure of the earth and isostacy; terrestrial magnetism and atmospheric electricity; seismology; internal structure and constitution of the earth; radioactivity, geothermal heat and the age of the earth.

673. Physics of Light Production. H. J. C. Ireton.

Courses 5i and 5r, IV Year; 1 hr. lecture per week, both terms.

Black body radiation, spectral energy distribution, and the principles involved in the production of light in various types of sources, filament, flame, gaseous, and vapour tubes.

674. Physical Laboratory. H. J. C. Ireton.

Course 5i, IV Year; 3 hrs. laboratory per week, both terms.

Accompanying subject 673.

PRACTICAL EXPERIENCE

690. Practical Experience.

Course 1.

Every student in Civil Engineering is urged to obtain the maximum amount of practical experience possible, during the summer vacations of his course. He must, before graduation, present satisfactory evidence of having had an experience of at least 600 hours on work acceptable to the Department. He is required to submit to the Department by the first day of the Session a report of not less than fifteen hundred words on the work in which he has been engaged during the summer. Failure to meet these requirements will result in a condition in practical experience.

691. Practical Experience.

Course 2.

Every student in Mining Engineering is required to present, before graduation, satisfactory evidence of having had at least six months' practical experience in work connected with Mining, Metallurgy, or Geology, for which he must have received regular wages.

The time may be spent in geological survey, ore dressing, smelter, or lixiviation works, in prospecting, or on any work in or about a mine other than as an office man or clerk. Prospecting will count only one-half (e.g., four months' prospecting will be counted as two months) and must not be submitted for more than three of the six months. Not more than three months on geological surveys or in assaying will be accepted as part of the six months. It is important to note that this experience may be obtained before the student is admitted to the University.

692. Practical Experience.

Course 3.

Every student in Mechanical Engineering is required to spend 1200 hours in mechanical work satisfactory to the Department. Half of this work is required to be done before February of his Third Year and the balance before February of his Fourth Year. Proof is to be given the Department before the dates mentioned.

All or any part of this shop work may be completed before the student enters the University, and he is urged to complete all of it at as early a date in his course as possible.

Failure to meet the specified requirements within the time set will result in a condition in shop work.

Certificate forms for this work may be obtained from the Department of Mechanical Engineering.

(*a*) Third Year—600 hours.

The student is required to obtain this practical experience in

industry, preferably in the foundry, the forge shop, and the machine shop. Such work assists the student in his understanding of the lecture and laboratory work throughout his entire course in Mechanical Engineering, and particularly the design work in his Third and Fourth Years.

Instruction regarding the type of work which is acceptable, and any special requirements, will be given by the Department to the student during his Second Year.

(*b*) Fourth Year—the balance of 1200 hours.

This is a continuation of the work outlined for the Third Year.

Instruction regarding the type of work which is acceptable, and any special requirements, will be given by the Department to the student during his Third Year.

693. Practical Experience.

Course 4.

Every student in the School of Architecture is required to spend at least 12 months (1,900 hrs.) in practical work and satisfactory evidence of its completion must be submitted before the granting of a degree. This work is done during the summer vacations, and is normally done in an architect's office for the whole period of 12 months. A student may, on application to the School of Architecture, be given permission to spend up to 6 months of this period with an engineer, a recognized contractor, or other firm conducting work in connection with building. At least 6 months' practical work in a recognized architect's office is obligatory.

695. Practical Experience.

Course 7.

Every student in Electrical Engineering is required to submit, before graduation, satisfactory evidence of having had at least 1200 hours' experience in work connected with engineering practice. Certificate forms may be obtained from the Department of Electrical Engineering and the completed certificates should be returned to the Department as soon as possible after the completion of each period of work.

696. Practical Experience.

Course 9.

Every student in Mining Geology is required to submit, before graduation, satisfactory evidence that he has spent at least six months in field work. This work may consist of prospecting, work around mines, or service on geological field parties.

698. Practical Experience.

Course 11.

Each student in this course is required to spend 1200 hours doing practical work, before graduation. This time should preferably be spent in the actual performance of manufacturing or constructional operations in industrial plants or engineering enterprises. Such experience will be valuable in promoting a better understanding of lectures and laboratory work and will assist the student in appreciating the workers' viewpoint.

SURVEYING

710. Surveying. S. R. Crerar, E. W. Banting, J. W. Melson, T. L. Rowe, S. H. deJong.

Courses 1, 2, 3, 5, 6, 7, 8, 8a, 9 and 10, I Year; 1 hr. lecture per week, first term.

General principles and practice of surveying with the chain, the transit, and the level, with special attention given to co-ordinative surveying.

Text books: Plane Surveying—Tracy. Elementary Surveying—Breed and Hosmer. Surveying—Breed. Printed Notes on Elementary Surveying—The Staff in Surveying.

711. Surveying. T. L. Rowe

Course 4, I Year; 1 hr. lecture and 3 hrs. field work per week, first term.

General principles and practice of surveying with the chain, transit, and level, with special consideration given to the survey of lots and small estates.

712. Field Work. S. R. Crerar, J. W. Melson, T. L. Rowe, S. H. deJong.

Courses 1, 2, 3, 5, 6, 7, 8, 8a, 9 and 10, I Year; 3 hrs. per week, first term.

Practice in chaining; a complete survey of a piece of land with the chain and transit; keeping of field notes; the use of the transit in surveying closed figures and traverse lines, and in ranging straight lines; plotting by latitudes and departures and otherwise computing areas; instrumental work with the level; use of level and transit in setting out a proposed building and calculating the volume of excavations required.

714. Surveying. W. M. Treadgold.

Course 1, II Year; 1 hr. lecture per week, both terms.

Simple, reverse, and compound curves as applied to railroad and highway surveying. Stadia, plane table, and photographic surveying as applied to topographic work, and the main features of mine, hydrographic, and aerial surveying.

Text books: Searles, Allen (Field books for Engineers). Theory and Practice of Surveying—Davis, Foote and Rayner. Surveying—Breed and Hosmer. Printed Lecture Notes—W. M. Treadgold.

715. Surveying. E. W. Banting.

Courses 2 and 9, II Year; 1 hr. lecture per week, both terms.

Mine surveying, with problems related thereto. Simple curves, stadia and plane table topographical surveying.

Text books: Surveying—Breed and Hosmer. Mine Surveying—Durham. Introduction to Mine Surveying—Staley.

716. Field Work. W. M. Treadgold, E. W. Banting.

Course 1, II Year; 8 hrs. per week, first term.

Courses 2 and 9, II Year; 6 hrs. per week, first term.

Adjustments of the transit and level, minor problems in triangulation and traversing, levelling and plane table practice, curves and topography.

717. Construction Surveying. W. M. Treadgold.

Course 1, III Year; 1 hr. lecture per week, both terms.

Construction surveys are taken up under the following headings, and the work is treated as applying equally to railroads, highways, canals, transmission lines, etc.

Earthwork:

(*a*) Cross sectioning.

(*b*) Computation of volume.

(*c*) Mass or haul diagram.

Transition and Vertical curves (including super-elevation).

Railway turnouts and sidings.

Layout of roads and sewers.

Text books: Field Engineering—Searles. Railroad Curves and Earthwork—Allen. Route Surveying—Pickles and Wiley. Printed Notes—W. M. Treadgold.

718. Advanced Surveying. W. M. Treadgold, J. W. Melson.

Course 1, IV Year; 2 hrs. lectures per week, second term.

Lectures in precise surveying in primary traverses, base line measurement, and field triangulation; determination of geodetic positions.

719. Advanced Surveying. W. M. Treadgold, J. W. Melson.

Course 1, IV Year; 4 hrs. practical work per week, second term.

Adjustment of observations, application of Least Squares, and base line measurements.

720. Survey Camp. W. M. Treadgold, S. R. Crerar, E. W. Banting, J. W. Melson, T. L. Rowe, E. S. Moore.

Courses 1, 2 and 9, III Year, August 11 to September 20.

This course includes:

(*a*) Secondary Triangulation and Base Line Measurements.
(*b*) Stadia, Plane Table and Boundary Traverses.
(*c*) Highway and Railway Location.
(*d*) Cross Sectioning and Computation of Earthwork.
(*e*) Stream Gauging and Discharge Measurements.
(*f*) Hydrographic Surveying.
(*g*) Photographic and Micrometer Work.
(*h*) Stadia and Plane Table Topography.
(*i*) Mine Surveying.
(*j*) Observations for Time, Azimuth, and Latitude.
(*k*) Geological Survey.

Students in Courses 1, 2 and 9 will be required to take the Survey Camp between the Second and Third Years; on failure to do so, this subject will be carried as a supplemental in the Third Year.

THESIS

730. Thesis.

Course 1, IV Year.

Each student of the Fourth Year, Course 1, is required to prepare and present a thesis on an approved subject, in both oral and written form. Instructions regarding the form of the thesis, and the selection of subject, are given to students at the end of their Third Year. The written thesis must be submitted not later than the last day of the Fall term of the Fourth Year of study. Oral presentation of the theses is arranged for the Spring term during regularly assigned lecture periods.

731. Thesis.

Course 2, IV Year; 7 hrs. per week, both terms.

The thesis in this Course consists mainly of reports on original work done in the laboratories. In the Third Year the subject "Introductory Research" paves the way for the thesis. By October 15th the student decides on the subject of his thesis, in consultation with his professors. After this is decided the student uses his own initiative in the development of his work.

The thesis is divided into three parts. The first part, which is handed in not later than October 15th, contains the title, a statement of what the title is meant to convey, and an outline of the work proposed to be done. The second part is handed in during the first week of January, and contains a report of progress to date; it also enables the professor in charge to keep in closer touch with

the work. The third and final part is handed in two weeks before the beginning of examinations, and is a report of progress to date with final conclusions. The three parts combined constitute the thesis. There will also be required such additional written reports as may be deemed necessary by the Department.

732. Thesis.

Course 3, IV Year.

Printed instructions regarding thesis requirements are issued to each student by the Department of Mechanical Engineering, giving full particulars.

733. Thesis.

Course 5, IV Year.

Each student in the Fouth Year will be required to prepare a thesis on a subject approved by the Committee Administering the Course in Engineering Physics.

734. Thesis.

Course 6, IV Year.

The thesis describes the research work carried on by the student during four and a half months of the session. It must be type-written on unruled $8\frac{1}{2}'' \times 11''$ paper, accompanied by graphs and photographs where necessary. The unbound sheets are handed to the Department about April 15th, and are bound in board covers by the University Press.

735. Thesis.

Course 7, IV Year.

Each student is required to prepare a thesis on a subject approved by the Head of the Department of Electrical Engineering. Instructions regarding the form of the thesis will be given to the students at the end of the Third Year.

736. Thesis.

Course 8, IV Year.

Each student in the Fourth Year must prepare a thesis on a subject and in a form approved by the Head of the Department of Metallurgical Engineering.

The most usual type of thesis is on the result of extended search and reading in a specialized field of metallurgical theory or practice.

737. Thesis.

Course 8a, IV Year.

A written report of approximately 6000 words, on a subject approved by the Department. Material for this report is obtained from laboratory and library work, which is carried out under the supervision of a member of the staff.

738. Thesis.

Course 9, IV Year; 6 hrs. per week, both terms.

A report on an investigation made by the student. It is intended to test his ability to make an independent field or laboratory study of some geological problem. The problem chosen must be approved by the Committee Administering the Course in Mining Geology, and plans for the thesis completed not later than November 1st of the student's Fourth Year.

739. Thesis.

Course 10, IV Year.

Each student of the Fourth Year must prepare a written thesis on an approved subject of a length not less than 6000 words. This thesis is to be finished and submitted for binding on the first day of the second term.

740. Thesis.

Course 11, IV Year.

Each student in the Fouth Year, Course 11, is required to prepare and present, in both oral and written form, a thesis on an approved subject in the field of management. Instructions regarding the form of the thesis and the selection of subject are given toward the end of the Third Year.

ZYMOLOGY

750. Zymology. A. M. Wynne.

Course 6z, IV Year, in the field of management.

Properties of enzymes, the mechanism of enzyme action, oxidation in living cells, and the intermediary carbohydrate metabolism of yeast, bacteria, and animal tissues.

SECTION X. EXAMINATIONS

ANNUAL EXAMINATIONS

1. Annual examinations will be held in April except as provided in paragraph 2 below.

2. Annual examinations will be held at the beginning of the second term in all subjects completed during the first term.

3. Promotions from one year to another are made on the results of term work and the annual examinations. A student proceeding to a degree must pass in all term work and examinations in all subjects of his course, and at the periods arranged by the Council.

4. The pass marks required on written examinations and laboratory work of all departments are 50 per cent, with an average of 55 per cent on written examinations and an average of 55 per cent on laboratory work. Candidates who have attained the required average and who have failed in not more than two subjects will be required to pass supplemental examinations in those subjects to secure pass standing.

5. Honours will be granted to students who, at the annual examinations, obtain at least 50 per cent in each written subject, at least 60 per cent in each laboratory subject, and 75 per cent of the total number of marks allotted to the subjects of their course.

6. Honour graduate standing will be granted to those who obtain honours in the final year and in one previous year.

7. Candidates, except ex-service men, who fail to secure promotion in the First and Second Years will not be allowed to repeat the work of the year, the rule to be applicable to women, and to men whether of military age or not and whether belonging to a physical category acceptable for service in the armed forces or not. Candidates who fail in other years may, at the discretion of Council, be allowed to repeat the work of the year in which they have failed.

8. The restrictions stated in paragraph 7 are applicable for the present to the Session 1945-46 only.

9. A student who, in either term of the session, fails to perform satisfactorily the work of his course may not be allowed to present himself at the final examinations of the year.

10. A student should submit to Council immediately after its occurrence, evidence of any illness or mishap which occurs during the session; any petition for leniency on account of such incidents may be refused consideration if received after the third day following the last day of examinations.

11. A student who has failed to complete satisfactorily the course in Physical Training prescribed for the First Year will not be permitted to register in the Third Year; and a student who has failed to complete satisfactorily the course in Physical Training prescribed for the Second Year will not be permitted to register in the Fourth Year.

12. A student will not be allowed to write any examinations if he has not paid all fees and dues for which he is liable at that time.

SUPPLEMENTAL EXAMINATIONS

1. The supplemental written examinations will begin on the 10th day of September, 1945. Application (on the prescribed form) to take such examinations, including practical ones, must be received from the candidate by the Secretary of the Faculty not later than July 15th, and the fee named in Sec. VI, para. 10, received by the Bursar not later than September 1st. Council reserves the right to reject applications of, or impose penalties upon, those failing to comply with these requirements. Arrangements will be made to conduct supplemental examinations at the Survey Camp for those students in attendance at the Camp.

2. If a candidate desires to write upon an annual examination as a supplemental, his application must be received by the Secretary and his fee by the Bursar, for the January examinations not later than December 1st and for the April examinations not later than March 1st.

3. Except under very exceptional circumstances, pass standing must be obtained in all written supplementals before entering the next higher year, and in all laboratory supplementals before or during the Session of the next higher year as may be required by the Department concerned.

TERM EXAMINATIONS

Term examinations may be held in any subject and at any time at the discretion of the instructor, or by order of the Council, and the results of such examination may, if the Council so decides, be incorporated with those of the annual examinations in the same subjects.

EX-SERVICE PERSONNEL

The foregoing regulations are applicable to all students of the Faculty. Special problems of students who have served in His Majesty's Armed Forces will be considered individually by the Council.

SECTION XI. SCHOLARSHIPS

Through the generosity of friends of the University, encouragement has been given to both undergraduate and graduate work in the various branches, by establishing the following scholarships, prizes, bursaries, and medals.

A student will not be allowed to hold more than one of the following scholarships marked with an asterisk, but the published lists will show all those to which he would have been entitled, but for this provision. The Council may, at its discretion, award unallotted scholarships to the next eligible candidate.

Name	Years eligible	Amount	See page
*Baptie Scholarship	I	$100	150
*Harvey Aggett Memorial Scholarship	II	$75	151
*Boiler Inspection & Insurance Co. Scholarship	III	$150	151
*Jenkins Scholarship	III	$200	151
Association of Professional Engineers of the Province of Ontario Scholarships	II, III	$400	151
B.A.A.S. Medal	IV	....	152
Toronto Architectural Guild Medal	V	....	152
O.A.A. Scholarship	II	$100	152
Toronto Brick Company Prizes	V	$75 & $25	152
Heating and Ventilating Engineers Prize	III, IV	$25	152
E. I. C. Prize	III	$25	153
MacLennan-MacLeod Memorial Prize	I	$25	153
J. A. Findlay Scholarships	II, III	....	153
R.A.I.C. Medal	V	....	154
*Ransom Scholarship in Chemical Engineering	I	....	154
Archie B. Crealock Memorial Prize	III	$25	154
First Garnet W. McKee-Lachlan Gilchrist Geophysics Scholarship	II	....	155
Second Garnet W.McKee-Lachlan Gilchrist Geophysics Scholarship	II	....	155
*John M. Empey Scholarships	1, II, III	$300	155
The INCO Scholarship	IV	$500	156
Rhodes Scholarships	II, III, IV	£400	156
U. of T. War Memorial Scholarships	All	$250	157
McCharles Prize	All & Grad.	$1,000	157
1851 Exhibition Science Research Scholarship	Graduate	£275	158

SCHOLARSHIPS—*Continued*

Name	Years eligible	Amount	See page
Nipissing Mining Co. Research Fellowship	Graduate	$1,100	159
C.I.L. Fellowship in Chemistry..........	Graduate	$750	159
H. W. Price Research Fellowship in Electrical Engineering..................	Graduate	....	160
T. A. Russell Memorial Research Fellowship............................	Graduate	$1,000	160
Consolidated Mining and Smelting Company Fellowship....................	Graduate	$750	160
Canadian Institute of Steel Construction Research Fellowship.................	Graduate	$1,200	160
Canadian Lumbermen's Association Timber Research Fellowship...............	Graduate	$1,000	161
Elizabeth Speller Memorial Fund........	III, IV	....	161
Engineering Society Loan Fund..........	....	....	161
James W. Crocker Memorial Loan Fund...	....	....	161
T. H. Bickle Bursary..................	All	....	161
The Engineering Society Semi-Centennial Award............................	III	$75	162
The 1923 Engineering Alumni Bursary....	II, III	$150	162
The Women's Mining Association Bursary.	III, IV	$150	162
Applied Science Bursaries...............	I	$160	163
Hobbs Glass Limited Scholarship	V	$250	163

NOTE: On account of the continued tendency towards lower rates of interest it is possible that the value of certain scholarships or prizes at the time of payment may prove to be less than the amount stated in the calendar.

BAPTIE SCHOLARSHIP

The Baptie Scholarship is derived from a bequest under the will of the late Mrs. Margaret W. Baptie, of Ottawa, and the Board of Governors has directed that from the income a scholarship of One Hundred Dollars shall be awarded annually to an engineering student on the record of the First Year. The Board of Governors also authorizes a remission of fees in the case of the holder of the scholarship, up to Seventy-five Dollars.

The conditions of the award are as follows: That the scholarship be awarded to the student who, in the annual examinations of the First Year, enrolled in any one of the courses of Civil Engineering, Mining Engineering, Mechanical Engineering, Chemical Engineering, Electrical Engineering, or Metallurgical Engineering, obtains the highest aggregate percentage of marks in those subjects which are common to the First Year curricula of those courses. The first award was made on the results of the annual examinations of the Session 1925-26.

HARVEY AGGETT MEMORIAL SCHOLARSHIP

This scholarship was donated by the late Mr. J. T. Aggett, of Toronto, as a perpetual memorial to his son, the late Lieutenant Harvey Aggett, who enlisted in March, 1915, during his second year in this Faculty, and was killed in action at Passchendaele on 6th November, 1917.

This annual scholarship of the value of Seventy-five Dollars is to be awarded to a student of the Second Year in this Faculty who, obtaining honours and being one of the first three in his year by his standing at the annual examinations, has been adjudged highest of the three in general student activities and service in the University during his period of attendance.

BOILER INSPECTION AND INSURANCE COMPANY SCHOLARSHIP

The Boiler Inspection and Insurance Company of Canada offers a scholarship in the Course in Mechanical Engineering of the value of One Hundred and Fifty Dollars to the student who obtains highest honour standing in the regular examinations of the Third Year.

The successful candidate will be expected to proceed to his Fourth Year during the session next following the date of the award.

The amount of the award will be credited by the Bursar to the fees of the Fourth Year of the successful candidate.

JENKINS SCHOLARSHIP

The Jenkins Scholarship, presented by Jenkins Bros., Limited, Montreal, first awarded in 1925, has been donated to continue indefinitely.

This Annual Scholarship, of the value of Two Hundred Dollars, is awarded to the student of the Third Year registered in any course of the Faculty who has the highest aggregate of percentages for the First, Second, and Third Years.

ASSOCIATION OF PROFESSIONAL ENGINEERS OF THE PROVINCE OF ONTARIO SCHOLARSHIPS

The Association of Professional Engineers of the Province of Ontario offers the following scholarships to students registered in any course of the Faculty of Applied Science and Engineering (except Architecture):—

(*a*) Scholarships of One Hundred Dollars and Seventy-five Dollars, respectively, to the two students in the Second Year who, taking honours, obtain the highest per cent of the total number of marks allotted to the subjects of their respective courses.

(*b*) Scholarships of One Hundred Dollars, Seventy-five Dollars and Fifty Dollars, respectively, to the three students in the Third Year who, taking honours, obtain the highest per cent of the total number of marks in their respective courses.

These scholarships will not be awarded to students who hold other scholarships.

B.A.A.S. MEDAL

A bronze medal has been donated by members of the British Association for the Advancement of Science, for students of the Faculty of Applied Science and Engineering. This medal will be awarded to the student of the Final Year, in any course, who, taking honours, obtains the highest aggregate percentage in practical and written examinations in the Year.

TORONTO ARCHITECTURAL GUILD MEDAL

The Toronto Architectural Guild was the organization of local architects from which sprung the Ontario Association of Architects. When the new and wider association became firmly established, the Guild disbanded and handed over to a trustee board certain funds for the establishment of a medal to be awarded in the School of Architecture of the University of Toronto.

The Trustee Board, now that the fund has accumulated considerably, announces its intention of awarding this medal annually to a senior student showing outstanding ability in Architectural Design.

ONTARIO ASSOCIATION OF ARCHITECTS SCHOLARSHIP

The Ontario Association of Architects offers a scholarship of One Hundred Dollars to the student of the Second Year in the School of Architecture who, at the annual examinations, obtains the highest honour standing in Architectural Design. The scholarship was awarded annually from 1928 to 1940 inclusive and has been extended for a further period of five years.

TORONTO BRICK COMPANY PRIZES

The Toronto Brick Company offers two prizes, one of Seventy-five Dollars and one of Twenty-five Dollars, to those students of the Fifth Year in the School of Architecture who win first and second places in a competition arranged by the Staff in the School of Architecture for this purpose.

HEATING AND VENTILATING ENGINEERS PRIZE

The Ontario Chapter of the American Society of Heating and Ventilating Engineers offers an annual prize of Twenty-five Dollars, first awarded in 1931, for a period of five years, and extended indefinitely in 1935. The prize will be awarded to a student in either the Third or Fourth Year in any Course of the Faculty who, in the opinion of the Department of Mechanical Engineering, has written the most satisfactory thesis on a subject dealing with heating or ventilation, such thesis being prepared under special arrangements made by the Department of Mechanical Engineering, the result to be reported to the Council with the annual examination results. The thesis must be handed in not later than March 1st. The prize will not necessarily be awarded in any year.

Application should be made to the Department of Mechanical Engineering.

ENGINEERING INSTITUTE OF CANADA PRIZE

The Engineering Institute of Canada, having in view that one of its objects is to facilitate the acquirement and interchange of professional knowledge among its members, offers an annual prize of Twenty-five Dollars in this University, to continue for a period of five years, commencing 1931, to the student who, in his Third Year in any one of the six courses of Engineering, has proved himself most deserving as disclosed by the examination results of the year, in combination with his activities in the Engineering Society or with a local branch of another recognized engineering organization. This prize was extended in 1935 and again in 1940 for a further period of five years.

MACLENNAN-MACLEOD MEMORIAL PRIZE

The Graduating Class of 1910 has donated an annual prize to the value of Twenty-five Dollars, known as "The MacLennan-MacLeod Memorial Prize", in memory of their first Class President, George MacLennan, who was killed in action in France in 1917, and of Doug. MacLeod, their first Secretary, who died in France in 1916 from wounds received in action.

The prize is awarded to the First Year student in the Faculty of Applied Science and Engineering who ranks highest in Calculus among those who obtain standing without condition at the annual written examinations; or, in the event of more than one student obtaining equally high rank in Calculus, the award is made to the one of these who also has the highest standing in some other subject common to the competitors, such as Analytical Geometry, such subject to be determined by the Council of the Faculty.

An award will not be made in any year in which, in the opinion of the Council, no student obtains a sufficiently high standing in Calculus to merit the award. In any year in which no award is made, the income from the prize of that year will be available for a second award in any subsequent year.

J. A. FINDLAY SCHOLARSHIPS

These scholarships were established through a legacy bequeathed by the late Miss Janet Findlay to the Department of Mechanical Engineering. Two scholarships are available to students in this Course, one for a student in the Third Year, the other for a student in the Fourth Year, but only if the student continues his course in Mechanical Engineering. The selection will be made, on recommendation of the Head of the Department of Mechanical Engineering, from amongst the four students having the highest average percentage of marks at the annual examinations in the Second and Third Years respectively, but in making the award the student's general character, fitness for his profession, and financial circumstances will be given consideration. In case a student who has been

awarded one of the scholarships changes his course or does not attend this University during the next following session, he shall forfeit his right to the scholarship and the award shall be made to another eligible student.

ROYAL ARCHITECTURAL INSTITUTE OF CANADA MEDAL

The Royal Architectural Institute of Canada has presented a medal to be awarded annually to a member of the graduating class in the School of Architecture who, having completed the requirements for the degree, has obtained high standing throughout his course and gives promise of being an architect of distinction after graduation. The person to whom the award is made must be a British subject; he must have completed the entire course in Architecture in the School of Architecture of the University of Toronto, except in the case of a graduate of the Royal Military College who shall have completed at least the third, Fourth, and Fifth Years in the School; he must have obtained high standing throughout his course, particularly in Architectural Design, and his character, personality, and intellect must be such as to indicate that in the practice of his profession, he may be expected to attain distinction. No award will be made in any Session in which the Council of the Faculty of Applied Science and Engineering so recommends.

RANSOM SCHOLARSHIP IN CHEMICAL ENGINEERING

The Ransom Scholarship in Chemical Engineering is presented by A. C. Ransom, Esq., of Toronto, for the purpose of encouraging and giving financial assistance to students who choose the field of Chemical Engineering. This donation, consisting of $5,000, provides for a perpetual scholarship of an annual amount such as will be derived from the income of this sum. The first award was made on the results of the annual examinations of 1938.

The scholarship will be awarded annually to the student registered in the Course in Chemical Engineering who obtains the highest aggregate percentage of marks in the examinations of the First Year. The scholarship will be paid to the winner only if he proceeds to take his Second Year in the Course in Chemical Engineering in the University of Toronto.

THE ARCHIE B. CREALOCK MEMORIAL PRIZE

The Archie B. Crealock Memorial Prize is the gift of Mrs. Archie B. Crealock, in memory of her husband, an eminent bridge engineer and a graduate of the Faculty of Applied Science and Engineering of the University of Toronto. It is offered annually to the student of the Third Year in the Course in Civil Engineering, who, having obtained honours in that year, is deemed to be the most worthy of the award. The award is made primarily on the basis of academic standing in the structural subjects of the Year, but extra-curricular activities are also taken into consideration. The Prize consists of engineering books to the value of Twenty-five Dollars. The award will not necessarily be made in any year.

THE GARNET W. MCKEE-LACHLAN GILCHRIST GEOPHYSICS SCHOLARSHIPS

Financial assistance was received by Professor Lachlan Gilchrist of the Departments of Physics, University of Toronto, from certain organizations and individuals to help him in the prosecution of his research work in Geophysics. With the consent of the contributors, the unexpended balance of these gifts was transferred by Professor Gilchrist to the Board of Governors of the University to be used as an endowment for scholarships, two of which were established in the Faculty of Applied Science and Engineering. To this fund have been added additional amounts received from the estate of the late Garnet W. McKee and from the Hollinger Consolidated Gold Mines Ltd. They are awarded by the Senate, on the recommendation of the Council of the Faculty of Applied Science and Engineering. The first awards were made on the results of the Annual Examinations of 1941.

The First Garnet W. McKee-Lachlan Gilchrist Geophysics Scholarship. This scholarship, of the annual value of the income from $4,000.00, is awarded to the student in the Second Year in the Course in Engineering Physics who obtains the highest aggregate standing at the examinations of the First and Second Years in the Course, provided always that the student obtains honour standing at the examinations of the Second Year.

The Second Garnet W. McKee-Lachlan Gilchrist Geophysics Scholarship. This scholarship, of the annual value of the income from $3,000.00, is awarded to the student in the Second Year in the Course in Engineering Physics who, of those students who elect to proceed in the Third Year in the Geophysics Option of the Course, obtains the highest aggregate standing at the examinations of the First and Second Years, provided always that the student obtains honour standing at the examinations of the Second Year, and excluding always the student to whom the First Lachlan Gilchrist Geophysics Scholarship has been awarded.

If in any year there is no student who has fulfilled the conditions as laid down for the Second Lachlan Gilchrist Geophysics Scholarship, it shall be awarded to the student in the Second Year in the Course in Engineering Physics who obtains the second highest aggregate standing at the examinations of the First and Second Years of that Course, provided always that such student obtains honour standing in the examinations of the Second Year.

THE JOHN M. EMPEY SCHOLARSHIPS

The John M. Empey Scholarship Fund was established under a bequest of $10,000 in the Will of the late John Morgan Empey, B.A.Sc., 1903. Three scholarships of equal value are provided from the income from the Fund. One of these scholarships is awarded in each of the First, Second, and Third Years on the results of the annual examinations, to a student who, taking honours, obtains the highest average percentage of marks in the written and laboratory subjects of his Year. The scholarships are open

to any students registered in the Faculty. In case the winner of any one of these scholarships does not attend this Faculty during the session next following the award, the right to the scholarship shall be forfeited and the award shall be made to another eligible student. The scholarships were awarded for the first time in 1944.

THE INCO SCHOLARSHIP

The International Nickel Company of Canada, Limited, offers a scholarship of $500.00, commencing with the Session 1941-42, and from year to year thereafter as the Company may decide, to be awarded to a graduate of the Faculty of Applied Science and Engineering in Chemical Engineering, Metallurgical Engineering, Mining Engineering or Mining Geology, who has taken a consistently high standing in the majority of the subjects of his course, and who is adjudged by the Council of the Faculty to be most suitable to receive the award.

The applicant must proceed to the M.A.Sc. degree in the Session in which he receives the scholarship. Application must be made before May 1, to the Secretary of the School of Graduate Studies, with a statement of the research problem which he proposes to study.

THE RHODES SCHOLARSHIP

Subject to the temporary postponement mentioned below, the Rhodes Trustees offer two scholarships for award annually in the Province of Ontario, each of the value of £400 a year and tenable ordinarily for two years at the University of Oxford.

Each candidate must be a British subject with at least five years domicile in Canada, and unmarried; he must have passed his nineteenth but not his twenty-fifth birthday on October 1st of the year for which he is elected; and he must have reached such a stage in his course at the University that he will at least have completed the first year and have entered upon the second year of his course at a Canadian University.

In that section of the will in which he defined the general type of scholar he desired, Mr. Rhodes mentioned four groups of qualities, the first two of which he considered most important:

(1) Literary and scholastic attainments;
(2) Qualities of manhood, truth, courage, devotion to duty, sympathy, kindliness, unselfishness, and fellowship;
(3) Exhibition of moral force of character and of instincts to lead and to take an interest in his fellows;
(4) Physical vigour, as shown by fondness for and success in outdoor sports.

Some definite quality of distinction, whether in intellect, character or personality, or in any combination of these, is the most important requirement. Financial need does not receive special consideration.

Forms of application and full information regarding these scholarships may be obtained from D. R. Michener, Esq., 372 Bay Street, Toronto,

General Secretary for Canada. Selection is made in December each year for the scholarships for the year following. Application must be made to the Secretary on or before November 10th. When appointments are resumed there will probably be some change in the terms set out above.

The last scholarships awarded were for the year 1941. As many of the scholars-elect have had their scholarships suspended for the duration of the war with the possibility of resumption afterwards, the Rhodes Trustees have postponed the appointment of more Rhodes scholars until further notice.

UNIVERSITY OF TORONTO WAR MEMORIAL SCHOLARSHIPS

Four scholarships, each of the value of Two Hundred and Fifty Dollars, have been established by the Alumni Federation of the University from the War Memorial Fund to be awarded to students in the Faculties of Applied Science and Engineering, and Forestry.

The general basis on which scholarships may be awarded shall be as follows: (*a*) Standing in course of studies. (*b*) Relationship to active service in the Armed Forces of Canada. (*c*) Need of financial assistance. (*d*) Merit shown by participation and interest in extra-curricular undergraduate activities of the University. (*e*) Such other general qualifications as may commend themselves to the committee recommending the awards.

Information regarding these scholarships may be obtained from the Secretary-Treasurer of the Alumni Federation, 43 St. George St., to whom application for the same must be made before April 15th.

MCCHARLES PRIZE

This prize was established in connection with the bequest of the late Æneas McCharles of Provincial Government bonds of the value of $10,000, and is awarded on the following terms and conditions, namely, that the interest therefrom shall be given from time to time, but not necessarily every year, like the Nobel prizes in a small way: (1) to any Canadian from one end of the country to the other, and whether student or not, who invents or discovers any new and improved process for the treatment of Canadian ores or minerals of any kind, after such process has been proved to be of special merit on a practical scale; (2) or for any important discovery, invention or device by any Canadian that will lessen the dangers and loss of life in connection with the use of electricity in supplying power and light; (3) or for any marked public distinction achieved by any Canadian in scientific research in any useful practical line. The following conditions, as passed by the Board of Governors, determine the method of award:—

(1) The title shall be the McCharles Prize.

(2) The value of the prize shall be One Thousand Dollars ($1,000.00) in money.

(3) The term "Canadian" for the purpose of this award shall mean any person Canadian born who has not renounced British allegiance; and for the purpose of the award in the first of the three cases provided for by the bequest, domicile in Canada shall be an essential condition.

(4) Every candidate for the prize shall be proposed as such in writing by some duly qualified person. A direct application for a prize shall not be considered.

(5) No prize shall be awarded for any discovery or invention unless the same shall have been proved to the satisfaction of the awarding body, to possess the special practical merit indicated by the terms of the bequest.

(6) The order of priority in which the three cases stand in the wording of the bequest shall be observed in making the award; that is, the award shall go *caeteris paribus* to the inventor of methods of smelting Canadian ores; and, failing such inventions, to the inventor of methods for lessening the dangers attendant upon the use of electricity; and only in the third event, if no inventors of sufficient merit in the field of metallurgy and electricity present themselves, to the inventor distinguished in the general field of useful scientific research.

(7) The composition of the awarding body shall be as follows:—

An expert in Mineralogy,
An expert in Electricity,
An expert in Physics,

and four other persons. All of the members of this body shall be nominated by the Board of Governors of the University of Toronto.

THE 1851 EXHIBITION SCIENCE RESEARCH SCHOLARSHIPS

There will be no award of these scholarships during the present hostilities.

The Royal Commissioners for the Exhibition of 1851 have invited the University of Toronto to recommend annually one or more candidates in order of merit for science research scholarships, each of the value of £275 per annum and ordinarily tenable for two years. The Commissioners may make a supplementary grant up to £30 per annum for University fees, etc., payable by the scholar during his tenure of the award.

Each candidate recommended must be a British subject, and under twenty-six years of age except in very special circumstances; he must have been a student of science in a university institution for a period of not less than three years and must have spent one full academic year at this University ending not more than twelve months prior to the date of recommendation.

The record of a candidate's work must indicate high promise of capacity for advancing science or its applications by original research. Evidence of this capacity, which is the main qualification for the scholarship, is strictly required. The most suitable evidence is a satisfactory account by the candidate of research work already performed, and the Commissioners will

decline to consider the claims of a candidate unless such an account is furnished, or unless there is other equally distinct evidence that he possesses this qualification.

The scholar will be required to devote his whole time to research in some branch of pure or applied science at an institution in the United Kingdom or abroad, selected with the approval of the Commissioners.

The following are the departments of the University, the students of which are eligible to apply for these scholarships: 1. Bacteriology; 2. Biochemistry; 3. Botany; 4. Chemistry; 5. Engineering (chemical); 6. Engineering (civil); 7. Engineering (electrical); 8. Engineering (mechanical); 9. Engineering (metallurgical); 10. Engineering (mining); 11. Forestry; 12. Geology; 13. Mineralogy; 14. Physics; 15. Physiology; 16. Zoology.

A student shall not be deemed to be ineligible because of his being on the staff of the University, if he has not been in receipt of a salary of more than $800 per annum and the nominating board may, at its discretion, recommend candidates who have been in receipt of larger salaries provided that all other conditions are fulfilled.

A student shall be deemed to be eligible in the year in which he intends to graduate, but if nominated for the scholarship his nomination shall be subject to his being successful in passing his examination for his degree.

The nominating board consists of the following members appointed by the Senate:—the Chancellor, the President, the Provost of Trinity College, Dean Beatty, Dean Brett, Assistant Dean Ryerson, Dean Young, Dr. C. S. MacInnes and Mr. N. F. Parkinson, and the Board shall have power to call to its aid as assessor any member of the teaching staff.

Applications for these scholarships must be submitted not later than April 15th to the University Registrar from whom copies may be obtained of the general regulations of the Commissioners governing the award and tenure of the scholarship.

NIPISSING MINING COMPANY RESEARCH FELLOWSHIP

The Nipissing Mining Company has endowed a Research Fellowship in the Department of Mining Engineering, to be known as The Nipissing Mining Company Research Fellowship, of the annual value of Eleven Hundred Dollars.

This Fellowship is open to graduates of any University.

THE C.I.L. FELLOWSHIP IN CHEMISTRY

This Fellowship, the gift of Canadian Industries Limited, of the value of $750 is established for the encouragement of post-graduate work in Chemistry. It is open to any British subject who is a graduate of a recognized University. The holder of this Fellowship will be required to undertake research in any branch of Chemistry under the direction of the department designated by the Committee of Award. Application must be made, with full statement of qualifications and testimonials, to the Secretary of the School of Graduate Studies not later than March 1st.

THE H. W. PRICE RESEARCH FELLOWSHIP IN ELECTRICAL ENGINEERING

The H. W. Price Research Fellowship in Electrical Engineering consisting of the income derived from the sum of $10,000 donated by the Hydro Electric Power Commission of Ontario, will be awarded from time to time to a graduate in Electrical Engineering of any recognized University, registered in the School of Graduate Studies, wishing to proceed with an investigation in the field of Electrical Engineering.

Forms of application may be obtained from the Secretary, School of Graduate Studies, and should be returned with a statement of qualifications not later than March 1st. The first award was available in 1943.

T. A. RUSSELL MEMORIAL RESEARCH FELLOWSHIP

The T. A. Russell Memorial Research Fellowship in Physical Metallurgy, of the maximum value of $1,000, in the Faculty of Applied Science and Engineering will be awarded to a student registered in the School of Graduate Studies who undertakes advanced work in the field of physical metallurgy. Applications must be made to the Secretary, School of Graduate Studies.

CONSOLIDATED MINING AND SMELTING COMPANY OF CANADA, LIMITED, RESEARCH FELLOWSHIP

The Consolidated Mining and Smelting Company of Canada, Limited, offers annually a Research Fellowship in the School of Graduate Studies of $750.00 for a research related to non-ferrous metals, heavy chemicals, and fertilizers. The Fellowship is known as the "Cominco Research Fellowship."

It is open to graduates in Science, Engineering, or Agriculture of a recognized university and preferably a British subject resident in Canada.

Applications for the Fellowship must be made to the Secretary of the School of Graduate Studies, not later than September 1.

CANADIAN INSTITUTE OF STEEL CONSTRUCTION RESEARCH FELLOWSHIP

This fellowship, donated by the Canadian Institute of Steel Construction, is offered to encourage scientific research in steel construction. It is open to honour graduates in engineering of any recognized university. The holder of the fellowship must be registered in the School of Graduate Studies as a student proceeding to a post-graduate degree and must carry out a programme of study and research prescribed by the School of Graduate Studies. The annual value of the fellowship is not less than $750 for a seven months term and not more than $1,200 for a ten months term.

Application should be made to the Secretary of the School of Graduate Studies not later than September 1 and should be accompanied by an official transcript of the applicant's undergraduate record, together with a statement of his engineering experience.

CANADIAN LUMBERMEN'S ASSOCIATION TIMBER RESEARCH FELLOWSHIP

This fellowship, donated by the Canadian Lumbermen's Association, is offered to encourage advanced study and research in timber engineering. It is open to graduates in engineering and graduates in forestry of any recognized university. The fellow must be registered in the School of Graduate Studies as a student proceeding to a post-graduate degree and must carry out a prescribed programme of study and research in both engineering and forestry. It is intended that the work of this programme will extend over a period of two academic years. The annual value of the fellowship is $1,000, all of which might not be granted to one student.

Application should be made to the Secretary of the School of Graduate Studies not later than September 1 and should be accompanied by an official transcript of the applicant's undergraduate record, together with a state- ment of his experience in the forestry and construction fields.

ELIZABETH SPELLER MEMORIAL FUND

Through the generosity of Dr. F. N. Speller, of the class of 1893, the "Elizabeth Speller Memorial Fund" has been established, the annual income from which is available for loans to worthy students of the Third and Fourth Years of this Faculty. Applications for loans from this Fund should be made to the Secretary of the Faculty.

ENGINEERING SOCIETY LOAN FUND

In 1932 the Engineering Society repaid to the Board of Governors a series of annual grants which, over a period of years, had been made to the Society for special purposes. The Board of Governors, appreciating this action, set aside this sum, to be known as the Engineering Society Loan Fund, to provide loans to students of the Faculty of Applied Science and Engineering. The administration of the fund is carried out by a Committee appointed by the Board. The fund is not large, and only small loans can be made to relatively few students. Further inquiries should be made at the office of the Secretary of the Faculty.

JAMES W. CROCKER MEMORIAL LOAN FUND

This fund was established by Mrs. William Crocker in memory of her son, James W. Crocker, a graduate in Mining Engineering in 1938, who was killed in an accident in a mine in the same year.

THE T. H. BICKLE BURSARY

The T. H. Bickle Bursary is the gift of Mr. and Mrs. E. W. Bickle in memory of their son, T. H. Bickle, an undergraduate of Trinity College and a member of the Senior Intercollegiate Swimming Team at the time of his death in 1937. The income from the endowment of $1,000 will be awarded annually to a member of the Senior Intercollegiate Swimming

Team of this University in any year or faculty. The Committee of Award shall consist of the Dean of the Faculty of Arts, the University Registrar, the Director of Athletics, and the Honorary Coach of Swimming. In awarding the Bursary the Committee shall consider the character, scholarship, and general interests of the members of the team.

THE ENGINEERING SOCIETY SEMI-CENTENNIAL AWARD

The Engineering Society Semi-Centennial Award, to the value of Seventy-five Dollars, was established in 1931 to commemorate the semi-centennial of the founding of the "School". The award is made to a student entering the final year.

The selection is based upon the following qualifications, which bear equal weight in the selection of the winner: (*a*) General "School" activities. (*b*) Contributions to the Engineering Society Executive Committee. (*c*) Personality, and social and athletic activities. (*d*) Academic standing.

THE 1923 ENGINEERING ALUMNI BURSARY

The Graduate Class of 1923 of the Faculty of Applied Science and Engineering has presented the 1923 Engineering Alumni Bursary, having the value of One Hundred and Fifty Dollars annually, commencing 1939. This bursary is awarded annually to a student completing the Second or the Third Year; it may be awarded two years in succession to the same student, but will usually be awarded at the end of the Second Year. The award is made by a Committee of the Class of 1923, on the following basis:

(*a*) In addition to mental capacity, the student must show leadership ability and give promise, through his activities, of becoming a worth-while influence in the affairs of the profession and the community.

(*b*) While attention is given to scholastic ability, as evidenced by his academic standing, it is not the governing factor. He must, however, stand in the top quarter of his class.

(*c*) Special consideration is given to financial need.

Payment is made in three instalments following registration in the next year.

Information may be obtained from the General Secretary, University Alumni Federation, 43 St. George Street.

THE WOMEN'S MINING ASSOCIATION BURSARY

The Women's Mining Association has presented a Bursary having the value of One Hundred and Fifty Dollars annually, commencing 1939. The Bursary is awarded to a student entering the Third or Fourth Year in the Course in Mining Engineering, Metallurgical Engineering, or Mining Geology; it may be awarded two years in succession to the same student, but will usually be awarded at the beginning of the Third Year. The award will be made by a special committee appointed by the Association on the following basis:

(*a*) In addition to mental capacity, the student must show leadership ability and give promise, through his activities, of becoming a worthwhile influence in the affairs of the profession and the community.

(*b*) While attention is given to scholastic ability, as evidenced by his academic standing, it is not the governing factor. He must, however, stand in the top quarter of his class.

(*c*) Special consideration is given to financial need.

Application must be made to the Secretary of the Faculty within one month of the opening of the academic year.

APPLIED SCIENCE BURSARIES

To assist promising students in the secondary schools who would otherwise be prevented for financial reasons from entering the Faculty of Applied Science, the Board of Governors has allocated funds to assist such persons to commence work at the University. Five Bursaries, each amounting to $160, will be awarded in 1945 to those applicants who are considered by the Council of the Faculty to be most eligible. An applicant must have obtained First Class Honours in Mathematics and a high proficiency record in the remaining subjects at the Grade XIII examinations for the Province of Ontario, or their equivalent.

Each applicant must apply by letter, giving full particulars of his case, to the Secretary of the Faculty of Applied Science and Engineering not later than September 1, 1945. This application must be accompanied by a letter of recommendation from the principal of the secondary school where his standing was obtained, and if possible a second letter of recommendation from a graduate in engineering, preferably of the University of Toronto, who resides or practises in the vicinity. Application for admission to the University, accompanied by matriculation certificates, must also be submitted to the Registrar of the University at the same time that application for the Bursary is submitted to the Secretary of the Faculty. Some members of the engineering profession have agreed to act as counsellors to prospective students, and the name of one or more of these men residing in the neighbourhood of the applicant may be obtained on application to the Secretary of the Faculty.

HOBBS GLASS, LIMITED, SCHOLARSHIP

Hobbs Glass, Limited, offers a scholarship annually, commencing with the Session 1945-46, to the student of the Fourth Year in Architecture presenting the best solution to a problem of design set by the staff in Architecture in consulation with the donor. The value of the scholarship is the Fifth Year academic fee.

SECTION XII. LIBRARIES AND LABORATORIES

THE UNIVERSITY LIBRARY

The University Library building is situated on the east side of the lawn that lies to the south of University College. It contains reading-rooms for men and for women, a law reading-room, and a medical reading-room, besides departmental studies which may be used as study rooms for honour students in the various departments in which the professors hold seminary courses, and private studies intended for advanced students engaged in research work.

The University Library building is open from 8.15 a.m. to 10 p.m. during the academic term. In the vacation, it is open from 9 a.m. to 4 p.m. (1 p.m. on Saturdays). Books in ordinary use may not be taken out of the Library building or from the reserved book reading-rooms during the day-time, but are lent for the night after 3 p.m., to be returned the following morning not later than 10 o'clock. Books not in general demand may, on application, be borrowed for a longer period.

DEPARTMENTAL LIBRARIES

Periodicals and other literature in the University Library of special interest to the students of this faculty have been housed in the Electrical. Engineering, Mechanical, and Mining Buildings for convenient reference,

These departmental libraries are situated as follows:

Applied Physics	Room 22, Engineering Bldg.
Architecture	Room 37, Engineering Bldg.
Chemical Engineering	Room 53½, Mining Bldg.
Civil Engineering	Room 25, Electrical Bldg.
	Room 22, Engineering Bldg.
Electrical Engineering	Room 25, Electrical Bldg.
Geology	Room 74½, Mining Bldg.
Mechanical Engineering	Room 6, Mechanical Bldg.
Metallurgical Engineering	Room 37, Mining Bldg.
Mining Engineering	Room 314, Mill Bldg.

CIVIL ENGINEERING LABORATORIES

There are four main divisions comprising these laboratories, namely: Cement, Highway, Soil Mechanics, and Mechanics of Materials.

CEMENT LABORATORY

The Cement laboratory contains all the appliances necessary in making the usual physical tests on Portland cement. It is supplied with cabinets and apparatus for individual work and various shot machines designed for tension and transverse tests. In addition, the laboratory is equipped

with moulds, knock-down forms for beams, drying ovens, a curing room controlled for temperature and humidity, and other apparatus required in investigating the properties of aggregates and concrete mixtures.

HIGHWAY LABORATORY

The Highway laboratory is equipped to carry out investigations in bituminous and non-bituminous materials used in highway construction and maintenance. Among the more important pieces of apparatus are the Deval abrasion, the Page Impact, and the Dorry Hardness machines, a standard brick rattler, jaw crusher, diamond core drill with rock saw and grinding lap, bituminous extractor, viscosimeters, ductility and penetration machines, cementation test apparatus, electric ovens, constant temperature baths and special equipment for the determination of the properties of subsoils.

SOIL MECHANICS LABORATORY

The Soil Mechanics laboratory is supplied with apparatus designed for the investigation of the physical properties of soils. It contains a mechanical centrifuge for determining moisture equivalents, Dow liquid limit machines, consolidation and shear machines, Proctor compaction test apparatus, a penetration and bearing power machine, sampling tools, dispersing apparatus, hydrometers, etc., and a device for demonstrating the quicksand phenomena, permeameters.

MECHANICS OF MATERIALS LABORATORY

The Mechanics of Materials laboratory is available for the scientific and commercial testing of materials of construction such as iron, steel, timber, concrete, and masonry. The equipment includes a Riehle 400,000-lb. three screw power universal testing machine, with a capacity for beams and girders up to 28 inches in width and 16 feet in span, and for specimens in tension and compression up to 10 feet in length, a Riehle 200,000-lb. screw power universal testing machine, taking beams 18 feet in span, and tension and compression specimens up to 12 feet in length, a Riehle 100,000-lb. screw power universal testing machine, a Riehle 20,000-lb. screw power universal testing machine, an Olsen 20,000-lb. hand-power, wire testing machine, specially fitted for testing wooden columns with both fixed and pivoted ends, an Olsen 20,000-lb. hand-power universal testing machine, especially adapted for testing long columns, an Olsen torsion machine of 140,000 inch-pounds capacity for testing the strength and elasticity of shafts and rods up to 2 inches in diameter and 10 feet in length; a hand-power torsion machine of simple mechanical design for testing short shafts of a maximum diameter of one inch, a Riehle 5,000-lb. transverse load testing machine for flexural tests of bars of wood and metal up to 48 inches in length, an Olsen 200-lb. tension testing machine, designed for the testing of textiles.

There are also special machines, such as an Olsen (Izod) pendulum impact machine; Brinell, scleroscope, and Firth Hardometer for hardness testing; an Avery repeated stress (fatigue) machine of the rotating beam type; proving levers and standard weights, an elastic ring, and an Amsler 60,000-lb. box, for calibrating purposes.

The accessory equipment includes Berry and Olsen strain gauges, a Nalder dividing engine, Beggs deformeter gauges, a Fereday-Palmer stress recorder—an instrument ideally suited for determining stresses in actual structure — apparatus for measuring angular deformation, a strainometer for use in determining Poisson's ratio.

In addition to the above, there are available a large number of strainometers of the usual degree of precision. These include the Bauschinger, Martens, Unwin, Ames, Riehle, Johnson, Huggenberger, De Forest scratch gauge, and other types.

MINING ENGINEERING LABORATORIES

During 1931 the building containing these laboratories was entirely rebuilt and greatly enlarged. The new building is 72 ft. x 100 ft., and is four stories high with a basement under half of it. The top floor and part of the third are occupied by the assaying laboratories. The rest of the building is given up to the ore dressing and mining laboratories, the commodious library and study rooms, lavatory and shower baths, rooms for the staff, two rooms for research in ore dressing, a model and map room, and storerooms.

ASSAYING LABORATORY

The East and West Fire Assay laboratories occupy the top floor of the Mill Building. They are identical, with preparation, furnace, and balance rooms in sequence, while between and common to these is a supply room, and another for chemical work. This arrangement allows a natural flow of operations from sample preparation to final weighing. Equipment in general is ample to give individual work to 32 students, thus encouraging original effort and conserving time.

The grinding rooms have a Sturtevant 2 x 6 jaw crusher, a McCool 8″ eccentric plate pulverizer, buck-boards, samplers, screens, and cupel machines. A special laboratory sampler gives samples of indisputable similarity, thus confining variations in students' assays, to their work.

Each furnace room has six Fletcher-Russell gas, and two D.F.C. oil furnaces. Parting cabinets have fan exhaust and direct illumination. Each student is allotted a work place equipped with a pulp balance, weights, tools, fluxes, and locker for individual work.

The bead balances are modern instruments by Ainsworth, Becker, Heusser, Keller, Oertling, Thompson, and Voland. Some have special rider devices and a sensitivity of 0.002 milligram. Each has independent lighting and is mounted on a cork insulated pier.

A sample room houses a wide variety of ores, mill products, mattes, bullion, and alloys from typical mines and smelters. Thesis, service, and study rooms on the third floor provide facilities and equipment for student research. Two staff rooms are used for the determinations necessary for instructional purposes and for research. A Hoskins electric furnace with Leeds-Northrup controllers and recorder is installed here. Other equipment includes pyrometers, microscope, electrolytic apparatus, and bullion rolls.

MINING LABORATORY

The Mining laboratory makes use of the ore dressing equipment as required. It is also equipped with an Ingersoll-Rand type ER-1 compressor and a variety of air driven rock drills representing the development of this machine. Blocks of synthetic ore for practising sampling and rock drilling are made up as required. A laboratory has been completed for the study of ventilation problems, air conditioning, dust counts, etc. In the main basement are bins for the accommodation of a large variety of ores from various mining districts.

ORE DRESSING LABORATORY

The main Ore Dressing laboratory, 72 ft. x 53 ft. x 22 ft. high, is equipped with the old five stamp battery with amalgamation plates, Wilfley table, Deister Plato table, Deister slime table, an old-fashioned buddle, and classifiers. Parallel with the stamp mill is a ball mill 30 in. x 24 in., which can be used alternatively with the stamps in connection with the concentrating tables. At one side of this main laboratory is apparatus representing the complete flow-sheet of a modern concentrator designed for continuous operation at the rate of 50 to 100 lb. per hour. This plant consists of feeders, two rod mills and a ball mill each 18 in. x 12 in., with classifiers, two Wilfley tables, a Dorr type thickener, a six-cell Fahrenwald Sub A flotation unit, a conditioner, a small pilot Wilfley table, and a Genter thickener. Another laboratory, 70 ft. x 25 ft., is set aside for batch work, and contains a variety of flotation machines, small ball and rod mills, small jigs, apparatus for cyanide tests and for tests in magnetic concentration. Other rooms are set apart for hand screening, microscopes, balances, a chemical room, and a room for roasting and other high temperature testing of ores in connection with ore dressing. For further research in ore dressing, there are available, Haultain Superpanners and Infrasizers, briquetting apparatus and metal lap machines for the polishing of briquettes in the study of minerals and mill products. The laboratory is also equipped with a Panphot microscope and accessories.

The Crushing laboratory contains a Hadfield gyratory crusher, a set of rolls 16 in. x 12 in., two small Dodge crushers, two sets of miniature rolls, two disc grinders, and a dry screening machine of the Feraris type. Adjoining this room is a large room for practising sampling methods.

MECHANICAL ENGINEERING LABORATORIES

HEAT ENGINE LABORATORY

Instruction in this laboratory covers the examination and testing of steam engines and boilers, and of internal combustion engines of the Diesel and automobile types, as well as stationary power units. Experiments on the octane rating of fuels, heating values of coal, etc., and the action of injectors and heat transmission apparatus are made. On the mechanical side, experiments are made on static and dynamic balancing, belt testing, oil testing, etc.

The part of the building set apart for thermodynamics and mechanical work is the ground floor of a room 60 ft. x 155 ft. This room is lighted entirely from the roof in an efficient way. A part of the space 40 ft. wide running the entire length of 155 feet is served by a 3-ton travelling crane, and contains the following equipment:

50 h.p. Brown engine with separate jackets on both heads and barrel of cylinder.

Two-stage Rand air compressor having compound steam cylinders, each fitted with Meyer cut-off gear. The low pressure air cylinder has Corliss inlet gear.

30 h.p. high-speed Leonard tandem compound engine with shaft governor.

40 h.p. Uniflow engine.

25 h.p. General Electric steam turbine.

Two 15 h.p. Leonard engines with different types of valves, which are used for valve setting, presented by E. Leonard & Sons.

Centrifugal air compressor.

There are also two surface condensers with air pumps so arranged that any engine in the laboratory may be made to exhaust into the atmosphere through an open heater, or into one of the condensers, the change from one arrangement to the other being accomplished in a few minutes without the aid of valves.

The laboratory further contains:

A 3-ton York refrigerating machine with tanks.

An Amsler transmission dynamometer.

Apparatus for testing injectors and steam pumps.

Hot blast heating equipment.

Experimental air conditioning apparatus.

Numerous other pieces of apparatus and instruments.

The work on internal combustion engines is performed on the following:

14 h.p. National gas engine arranged for various compressions and points of ignition.

25 h.p. horizontal Diesel engine made by Ruston and Hornsby, especially arranged for testing.

25 h.p. Allen semi-Diesel engine.

25 h.p. tractor gasoline engine.

Six cylinder Chevrolet automobile engine. (Presented by the makers.)

200 h.p. Sprague electric dynamometer.

Eight cylinder Ford automobile engine. (Presented by the makers.)

Leyland six cylinder Diesel engine.

Hercules six cylinder engine for various fuels.

Standard C.F.R. fuel rating engine for finding the octane rating of fuels, etc.

Various accessories to above machines.

Steam for the laboratory is supplied by two 50 h.p. and one 100 h.p. Babcock and Wilcox boilers, the latter having an internal superheater. These boilers are located in a separate boiler room. They are used for experimental work only and are fitted up for testing. The gases pass up through two independent chimneys, and these have been arranged so that the draft and other conditions in the chimney at any point of its height may be examined.

In smaller work-rooms off the main laboratory are placed belt and oil-testing machines, and apparatus for testing the efficiency of machines.

A Carwen Olsen balancing machine for static and dynamic balancing has recently been installed.

HYDRAULIC LABORATORY

The Hydraulic laboratory is designed to give practical hydraulic experiments illustrating the laws of flow of fluids in pipes, through orifices, over dams, etc. Friction loss may be measured, and the action of various types of meters, with their coefficients, is examined. Measurements of the efficiency and best methods of operation of pumps, and of turbines of various types, are also determined and problems relating to water power development, also to the movement of fluids, find a place in this laboratory.

The laboratory occupies two floors, each 40 ft. x 112 ft., and the apparatus therein may be briefly listed as follows:

Two 2-stage Gwynne centrifugal pumps, each for one cubic foot per second at 125 feet head.

Two 2-stage Escher Wyss turbine pumps, each for one cubic foot per second at 150 feet head.

These four pumps may be run in parallel for four cubic feet per second at 125 feet head, or in any desired series arrangement giving one cubic foot per second at not over 550 feet head, thus allowing for a wide range of experimental work.

A 125 h.p. Belliss and Morcom engine of 525 r.p.m. for driving the four pumps mentioned, and for experiment if desired.

A motor driven turbine pump for six cubic feet per second at 65 feet head for supplying the turbines.

An open trough five feet wide and 110 feet long for towing models and meters, and for certain types of open channel work.

A small reciprocating experimental pump.

A four stage motor driven turbine pump for experiments.

An Escher Wyss reaction turbine, 13½-inch runner, built specially for the laboratory.

A 24-inch Pelton turbine specially constructed for study.

A 12-inch Doble impulse turbine.

A reaction turbine with both Francis and propeller runners designed for this University.

An experimental centrifugal pump and meters.

A Kaplan turbine also made for test purposes.

A concrete and steel flume built primarily for research work on turbines.

A Moody spiral pump, motor driven, for a delivery of twelve cubic feet per second at low head.

A very carefully designed dynamometer and efficient set-up to enable reliable efficiency tests to be made with great accuracy.

A vertical steel tank 5½ feet diameter and 34 feet high to be used as a reservoir, also for experiments on nozzles, valves, meters, etc.

A weir tank 6 feet wide and 21 feet long with hydraulically operated valves.

Two measuring tanks, each of 240 cubic feet capacity, each mounted on accurate scales and to be used to calibrate the weirs or to weigh large quantities of water.

Three tanks, each 3 feet wide and 12 feet long, for experiments on orifices and weirs.

Six measuring tanks for calibrating the above orifices, etc.

A glass sided trough 30 feet long for studies on weirs, dams, and similar structures.

Venturi meter, hydraulic ram, Pitot tubes, numerous models, gauges, gauge tester, and all apparatus necessary for the above mentioned studies. The laboratory piping has been designed to give wide variety of operation of the system. Piping has been set up for friction and nozzle experiments and other work.

The laboratory is indebted to the Dominion Engineering Works, Montreal, and to the late Mr. William Inglis and others for generously supplying parts of the apparatus.

CHEMICAL ENGINEERING LABORATORIES

The Chemical laboratories are situated in the Mining Building, and are supplied with the usual modern equipment.

Seven large laboratories, each with its own balance room, and seventeen small laboratories are in steady use. Some of the latter are specially equipped for work in such fields as gas analysis, calorimetry, polarimetry, hydrogen ion investigations, and water analysis. A fireproof room is provided for work with volatile solvents and organic analysis, and special equipment for semi-micro analysis is permanently maintained. Nine of the small laboratories are set apart for undergraduate and graduate

research, and a room is set apart for the construction of glass apparatus by the glassblower connected with the department, in which instruction in glassblowing is given to students. One of the large laboratories, approximately forty feet square, is equipped for the experimental study of chemical engineering and industrial chemistry. Among the apparatus installed there are: a stoneware column for the investigation of the absorption of gases by liquids, fractionating still, heat transfer apparatus filter press, vacuum evaporator, sulphonator, fusion pots, autoclaves, jacketed kettle, tanks, pumps, meters, and other necessary accessories. Each of these is used by undergraduates, and is further employed from time to time in research.

ELECTRICAL ENGINEERING LABORATORIES

The Electrical laboratories, located in the Electrical Building, are equipped for studies related to principles discussed in lecture courses rather than for routine tests.

The power services to all laboratories are 230-115 volts, direct current; 115 volts, three phase, 25 cycles; and 115 volts, three phase, 60 cycles. Power for the laboratories is supplied by the University Central Heating and Power Plant in the form of 230-115 volts, three wire, direct current. The alternating current services are supplied from two main motor-generator sets which are equipped with automatic voltage and speed regulators.

These different services, combined with a system of spare conductors, make it possible to conduct a great variety of experiments in any one of the laboratories. In all laboratories the measuring instruments are of the highest quality.

ALTERNATING CURRENT MACHINE LABORATORY

The Alternating Current Machine laboratory, located on the first floor, contains the main 25-cycle and 60-cycle service sets referred to above. For experimental purposes the following equipment is available: two 15 kva. motor generator sets, d.c. to 60-cycle a.c.; two 15 kva. motor generator sets, d.c. to 25-cycle a.c.; two 10 kva. 60-cycle phase displacement dynamometer sets; a 25 h.p. low speed (322 r.p.m.) 60-cycle synchronous machine which produces an emf. wave very close to sine form; a 5 kw. 60-cycle synchronous converter; a mercury-arc rectifier; transformers; a.c. motors of all types; a model transmission line; two electromagnetic and two cathode ray oscillographs; and all necessary auxiliary apparatus.

DIRECT CURRENT MACHINE LABORATORY

The Direct Current Machine laboratory, located on the second floor, has a 40 kw. 230 volts d.c. to 115 volts d.c. motor-generator set with Tirrill regulator for special tests. Other equipment includes a number of 5 to 10 kw. motor-generator sets for d.c. generator tests; shunt, series and

compound motors with and without interpoles; and other necessary apparatus such as loading racks, rheostats, circuit breakers, prony brakes and motor starters.

ELECTRICAL MEASUREMENTS LABORATORY

The Electrical Measurements laboratory, located on the top floor, is fitted with a convenient arrangement of power supply including a very flexible storage battery service and a 1,000-cycle service in addition to the standard a.c. and d.c. services. The equipment includes galvanometers, resistance boxes, Wheatstone bridges, shunts, potentiometers, standard cells, bond testers, condensers, and such other apparatus required for making a great variety of studies in measurements by direct and alternating current methods.

COMMUNICATION LABORATORY

The Communication laboratory, located on the top floor, is equipped for setting up and measuring vacuum tube circuits of all usual types; and for measuring the properties of networks at both low and high frequencies. Cathode ray oscillographs, harmonic analyzers, amplifiers for bridge balance, etc., are available. A 1,000-cycle supply of good wave form is located at all measuring points in the laboratory. A separate room is treated acoustically and equipped with the necessary apparatus for the study of electrical reproduction of sound.

SPECIAL LABORATORIES

A few smaller laboratories are set apart for particular studies. These include a high voltage laboratory with a 200,000-volt transformer and a 50,000-volt transformer complete with controls; a room with a specially designed model transmission line for the study of line characteristics, and a room with a small electric furnace for studies of the effect of temperature on materials from an electrical engineering point of view.

Study rooms are associated with the laboratories for design studies and engineering problems.

METALLURGICAL ENGINEERING LABORATORIES

These laboratories, in the east end of the Mining Building, occupy approximately 3,600 square feet on the basement floor and the same space immediately above on the ground floor. The furnace room contains a motor driven Connersville blower, several gas-fired furnaces, and two small blast furnaces. The larger electric furnaces of the Department of Chemistry (Electrochemistry) are in this room. Some are supplied with direct current, others with alternating current from a 200 K.V.A. transformer. A system of flues, with hoods over all the furnaces, leads to a stack through which gases are pulled by a fan.

Hydro-metallurgical equipment includes apparatus for leaching and electrolytic precipitation in circulating systems.

Situated in these two rooms, also, is most of the equipment used in the teaching of ceramics and non-metallic industrial materials. The apparatus includes a dry pan, a small dry press, a plunger machine with tile and hollow ware dies, an Abbé six-jar ball mill, a recuperative down draft clay testing furnace of brick construction, a small Seger test furnace, a high temperature oxygen acetylene furnace, a high temperature electric muffle furnace heated by "globars", and standard screens, volumeters, elutriation apparatus, driers, and such sundries as are necessary for clay testing.

The upper floor is divided into laboratories, a library, store rooms, and offices. The laboratories are for metallurgical analysis; heat treatment and pyrometry; grinding, polishing, and etching; metallographic room, with two adjoining dark rooms.

The laboratory for metallurgical analysis is well equipped to give students training in mill and smelter methods, the analysis of ores, furnace products, ferrous and non-ferrous alloys, and specialized ceramic bodies.

In the heat treatment and pyrometry laboratory there are a number of gas and electric furnaces, a Leeds and Northrup micromax potentiometer, a disappearing filament pyrometer, a radiation pyrometer, and thermocouples for use with millivoltmeter or potentiometer.

For grinding and polishing there are provided many sets of emery papers and six motor-driven polishing wheels.

The metallographic room is equipped with a horizontal Bausch & Lomb photomicrographic camera, a Leitz micro-camera attachment, two vertical cameras, and nine metallographic microscopes.

The laboratories also contain a "Tensometer" for making tensile tests, notch bar tests and Brinell tests on small test pieces, a Leeds and Northrup type "K" potentiometer for determining critical points, a Rockwell hardness testing machine, a Shore scleroscope, an emery cutting disc, and a mechanical saw.

APPLIED PHYSICS LABORATORIES

The Applied Physics laboratories, situated in the Engineering Building, are equipped as follows:

The Photometric laboratory is equipped with precision and portable photometers for the measurement of candle-power, illumination, and brightness; integrating spheres for determining the luminous output and efficiency of lamps and luminaires; and colorimeters, spectro-photometers, and flicker photometers for the measurement of colour. Standards of candle power, luminous flux, and colour temperature are maintained and a 132-volt storage battery with all electrical controls and meters necessary for precise photometry are provided.

The Illumination Design laboratory is equipped for demonstrating and measuring the performance of lighting installations.

The Optics laboratory is equipped with optical benches, etc., for the testing of lenses, and with examples of various optical instruments for instruction in their theory and applications.

The Photographic laboratory is equipped with cameras, dark rooms, and accessories for practical work in photography, and with sensitometers, spectrographs, and densitometers for the testing of photographic materials. A Zeiss phototheodolite, stereoscopes, stereocomparator, and plotting apparatus are provided for instruction in photographic surveying.

The Acoustical laboratory is equipped with the ordinary apparatus, such as forks, pipes, strings, etc., for illustrating the elementary laws of acoustics. There are also two rooms for work in sound transmission and absorption, equipped with an audio-frequency oscillator for the production of sounds of constant intensity, and microphones and amplifiers for, reception.

UNIVERSITY SURVEY CAMP

In 1920 the University purchased approximately 175 acres of land comprising a tract of field, woodland, and lake front property in the County of Haliburton, and erected permanent buildings for the use of students in Civil Engineering, Mining Engineering, Mining Geology, and Architecture, as well as for other students taking special work. The country is broken and rolling, and with the numerous small lakes and streams in the immediate vicinity, is admirably suited for work and the various problems that arise in practical surveying. The camp is at an elevation of about 1,000 feet above sea level and a secondary triangulation has been carried out, the stations of which are connected with the primary stations of the Geodetic Survey of Canada. Permanent bench marks have been established and connected up with the precise level net of Canada.

The Camp may be reached by the Canadian National Railways, via Lindsay to Gelert, where conveyances are always on hand to drive direct to the camp by way of Minden, a distance of 12 miles. There is also a daily bus service from Lindsay to Minden.

The Camp, located 4 miles south of Minden, on the west side of Gull Lake, can be reached by road after leaving the main Provincial highway at Minden. There are four main buildings, including a Dormitory, Administration, Staff, and Dining Hall Building, which are suitably furnished and provided with electric lighting and drafting accommodation. Accommodation for 80 students can be provided, and a large proportion of the equipment of the Department is transported to the Camp for use during the summer session.

Mail, telegrams, or telephone messages should be addressed to "University Survey Camp, Minden, Ontario".

METROLOGICAL LABORATORY

The Department of Surveying and Geodesy is provided with all the ordinary field instruments, such as transits, levels, compasses, micrometers, sextants, planimeters, plane tables, tapes, chains, etc., with which is carried on the instruction in practical field operations as detailed elsewhere.

A small laboratory is also established in the basement of the observatory described below, containing the necessary instruments for the refined measurements of geodetic surveying; as, a standard yard and metre, a Rogers 10-foot comparator, an invar base measuring apparatus, a Kater's pendulum with vacuum chamber, a level trier, micrometer microscopes, etc.

The geodetic observatory in connection with this department is used for the instruction of students of the Fourth Year in taking observations for time, latitude, longitude, and azimuth by the precise methods used in connection with a geodetic survey. It contains a 10-inch theodolite and zenith telescope by Troughton & Simms; an astronomical transit instrument and an 8-inch theodolite by Cooke; two electro-chronographs; a Howard astronomical clock; a Dent sideral clock; a Dent sideral break-circuit chronometer; a wireless receiving instrument; arithmometers, etc.

AERODYNAMIC LABORATORY

The Aerodynamic Laboratory is fully equipped with an improved 4-ft. Royal Aircraft Establishment type wind channel, aerodynamic balance, micromanometers and other necessary instruments.

Air speeds of 80 feet per second can be secured in a stream of great steadiness and uniformity and higher speeds with some sacrifice in steadiness.

The work done in the Laboratory includes the investigation of problems in aerodynamics, tests of air craft components, and complete machines, rating of meters, ventilators, radiators, etc., and the study of the effect of wind pressure on structures, chimneys, etc.

ONTARIO DEPARTMENT OF HEALTH LABORATORY

Through the courtesy of the Provincial Department of Health, the facilities of the well-equipped experimental laboratory, which the Department operates at Stanley Park (807 Richmond Street West), have been placed at the service of the University for the investigation of problems associated with all phases of Sanitary Engineering. Equipment and means are available for study and research in the various processes employed in sewage treatment, the different methods of water treatment, and the bacteriological and chemical examinations on water, sewage, air, milk, and all factors in sanitation.

ELECTROCHEMICAL LABORATORIES

The Electrochemical laboratories, which are situated in the Mining Building, are provided with special facilities for electrolytic work, including a large storage battery and electroplating dynamo with tanks, as well as a set of apparatus and electrical measuring instruments, for both undergraduate work and research. The experimental work on electric furnaces is carried out in a large furnace room in the basement, occupied jointly by the Department of Metallurgical Engineering and the Department of Chemistry (Electrochemistry). The equipment for this purpose comprises a 120 kw., 220 volt supply of direct current from the main power house through a switchboard, rheostats, circuit-breaker, and instruments to a set of distributing bus-bars, and a 200 k.v.a. transformer stepping down from 2,200 volts to 30-120 volts in 3 and 6 volt steps, which supplies alternating current at 25 cycles. There is a complete set of A.C. instruments, circuit-breakers, oil-switches, relays, automatic regulating winches, etc., and a Northrup high frequency furnace with its transformer is also installed. The two departments co-operate in the use of a Hoskin carbon plate furnace and a resistor tunnel furnace. Facilities for the study of high current carbon arcs and the thermal behaviour of refractories are also provided.

GEOLOGICAL LABORATORIES

The Geological laboratories are equipped for the study of geology from the modern viewpoint. Collections of rocks and minerals, models and natural specimens illustrating various geological features, topographic and geological maps for exercises in map reading, and fossils are all employed in the study of general geology. Typical index fossils are utilized, along with geological maps, in historical geology.

In the Economic Geology laboratory, numerous suites of specimens of ores and rocks illustrate the nature and occurrence of the deposits in many mining camps. A set of building stones, uncut, cut, and polished, is available for a course on that subject. These materials are studied megascopically and microscopically to determine the character and associations of their mineral constituents. The Metamorphic Geology laboratory is supplied with specimens, thin sections, and petrographic microscopes for the study of metamorphic minerals and the changes that rocks undergo in thermal and dynamic metamorphism. Hand specimens and thin sections of suites of rocks from numerous Precambrian areas are also available for work in Precambrian geology. Facilities are available for sawing and polishing specimens of ores, and rocks, and for making thin sections.

For work in structural geology, natural specimens and geological maps exhibiting complex structural conditions and structural problems illustrated by diagrams and drill logs, are extensively employed. For field methods in geology, the laboratories are supplied with geological and

topographic maps, survey instruments, and various other equipment, so that work in the laboratory may supplement that in the field.

MINERALOGICAL LABORATORIES

The Mineralogical laboratories in the Mining Building provide facilities for most types of investigation involving minerals, crystals, and rocks.

Courses in laboratory work in the personal examination of type sets of named minerals, crystals, and rocks serve to illustrate the introductory lectures. More advanced work is provided in the identification of unknown minerals by physical tests, blowpipe, and other methods.

To encourage the study of pure crystallography, the laboratories are supplied with goniometers of the various types, crystal models, appliances for the cutting of oriented crystal sections and for their physical examination. Practical petrography is carried on in rooms provided with type sets of rocks, both macroscopic and microscopic. Advanced students are taught to make thin sections of rocks and polished section of opaque minerals, and to study them microscopically.

The laboratory for the preparation of thin sections of rocks and minerals is provided with electric diamond saws and grinding appliances for the various types of work incidental to the preparation of thin sections. It is also equipped for the preparation of polished specimens for the microscopic examination of the opaque ore minerals.

The department is equipped with petrological and mineralographical microscopes, so that it is possible to provide advanced students with instruments and sets of thin sections and polished minerals for their own special use. Sets of index liquids and a universal stage are available for students interested in more advanced methods for determining the optical properties of crystals.

A well equipped X-ray laboratory, with suitable goniometers for the study of crystal structure, is available to qualified advanced students.

MUSEUM

The ROYAL ONTARIO MUSEUM, with exhibits in Archaeology, Geology, Mineralogy, Palaeontology and Zoology, is situated at the southwest corner of Bloor Street and Queen's Park.

Students of the University in all departments are recommended to avail themselves of the privileges of the Museum, which, although under separate control, is intimately connected with the work of the University.

The museum is open on Sunday from 2 p.m. to 5 p.m., and on week days from 10 a.m. to 5 p.m. with the exception of Monday when it is closed all day. The admission is free for the public on Tuesday, Thursday, Saturday and Sunday. On other days an admission fee of fifteen cents is charged.

By a resolution of the Board of Trustees all regular students of the University may be admitted free on showing their registration cards.

SECTION XIII. DISCIPLINE

1. (*a*) There is vested in the Council of each federated university or college, and of each faculty, disciplinary jurisdiction over and entire responsibility for the conduct of their students in respect of all matters arising or occurring in or upon their respective buildings and grounds including residences.

(*b*) Disciplinary jurisdiction in all other cases as respects all students is vested in the Caput.

(*c*) The Students' Administrative Council, in the discharge of all duties entrusted to it, will be supported in the due discharge of those duties by the disciplinary power of the Caput.

2. No student will be allowed to continue in attendance, whose presence is deemed by the Council of his college or faculty to be prejudicial to the interests of the University. The continuance of any student in attendance at a course in the University or the receipt by him of official certificates of standing or of graduation, is subject to such exercise of the disciplinary power of the Caput as may be necessary to enforce the regulations of the University and to maintain standards of personal conduct acceptable to the University. In the exercise of its disciplinary power, in the interest both of the University and of the student, the Caput will take into consideration the conduct of the student both inside and outside the University premises. In all cases an appeal to the Board of Governors may be made.

3. Students proceeding regularly to a degree are required to attend the courses of instruction and the examinations in all subjects prescribed for students of their respective standing, and no student will be permitted to remain in the University who persistently neglects academic work.

4. All interference on the part of any student with the personal liberty of another by arresting him, or summoning him to appear before any tribunal of students, or otherwise subjecting him to any indignity or personal violence, is forbidden by the Caput and by the Councils of the colleges and faculties.

5. No initiation ceremony involving personal violence, personal indignity, interference with personal liberty, or destruction of property, may be held by the students of any college or faculty of the University, under the penalty of suspension or expulsion.

6. Any reception of the students of the first year in any college or faculty must be approved by the Council of that college or faculty, but such reception must not involve any infraction of the regulations of the two preceding paragraphs.

7. The organizing of a parade in the streets of the city, or the taking part in such parade without the permission of the authorities of the city

on application of the Students' Administrative Council, will be regarded as a breach of discipline.

8. A student who is under suspension, or who has been expelled from a college or faculty or from the University, will not be admitted to the University buildings or grounds.

9. The constitution of every society or association of students in the Faculty of Applied Science and Engineering, and all amendments to any such constitution, must be submitted to and approved by the Council of the Faculty. All programmes of such societies or associations must, before publication, receive the sanction of the Council. Permission to invite any person not a member of a faculty of the University to preside at or address a meeting of any such society or association must be similarly obtained.

10. The name of the University is not to be used in connection with a publication of any kind without the permission of the Caput.

11. Students of any faculty or college on the premises of colleges or faculties other than those in which they are registered shall be subject to the regulations and penalties imposed by the administrative authorities of the premises concerned.

SECTION XIV. UNIVERSITY HEALTH SERVICE AND PHYSICAL TRAINING

UNIVERSITY HEALTH SERVICE

1. The facilities of the University Health Service are available to undergraduate students, both men and women.

2. Every student *must take an annual medical examination* conducted by the University Health Service. This examination will include a routine urinalysis, intracutaneous tuberculin test, and an X-ray film of the chest in the first and final years and in such other years as it may be considered necessary. Should the findings at the initial examination reveal any condition which in the opinion of the Director requires the advice of a specialist, the student will be examined by a consultant. Should the examination disclose evidence of a condition for which medical treatment is indicated, the student will be advised to consult his family physician or other doctor of his own choice. Such a student will be required to report back to the Health Service at stated intervals during the session in order that the Health Service may know that the student has acted on the advice given him. Should any postural defect or other condition be revealed for which exercises are considered advisable by the Director, arrangements for them will be made with the Director of Physical Education. Should the examination reveal any physical or other defect which, in the opinion of the Director, renders it inadvisable for the student to pursue his course of study, he will be so informed and a report on his case will be sent to the college, faculty or school concerned.

3. The examination will also determine whether or not the physical condition of the student is such that he may participate in athletic sports or games or attend the required physical training classes. *All students irrespective of year must have a medical examination by the Health Service before taking part in any university athletic activity. Students proposing to engage in such activities must make early appointments for their examinations.*

4. Any student may consult the University Health Service for medical advice between the hours of 9 a.m. and 5 p.m. daily (Saturdays 9 a.m. to 1 p.m.) and by appointment on Sunday if urgent. Any student who is taken ill in lodgings or in a residence and who has not a private physician will be visited if necessary. A nominal charge of $1.00 during the day (9 a.m. to 6 p.m.) and $2.00 at night (6 p.m. to 9 a.m.) will be made for each visit. These charges are payable by the student to the University Bursar. Any student who is taken ill or injured on the university grounds or premises will be given essential first aid treatment or advice. Further treatment is the responsibility of the student and must be arranged for privately.

5. While the University does not admit any legal responsibility for

injuries sustained by students because of athletic training or competition, the University Health Service has found it possible to provide for a measure of financial assistance towards the care of students injured while engaged in the required physical training classes or in recognized athletic activities on the campus. Such assistance is available only to students who pay the Health Service fee and who have satisfied the requirements of the Athletic Directorate in regard to athletic eligibility, and will be provided solely on the authorization of the Director.

6. The University Health Service will not meet the expenses of students who are not eligible to receive such assistance. It will not meet the expense of treatment of injuries received while the student is not actually engaged in recognized physical training classes or athletic activities. It will not meet the expense of treatment for which no official arrangements have been made with the Director prior to the end of the academic term in which the athletic injury occurred. Students who secure unauthorized service do so at their own responsibility. In any case involving questions of eligibility, medical and surgical fees, hospitalization, etc., the decision of the Director is final.

7. The University Health Service has in operation an Infirmary for men and an Infirmary for women. The Infirmary for men is situated on the third floor of the west wing of Hart House, and the Infirmary for women is established, through the co-operation of University College, in connection with the University College Women's Infirmary in the Women's Union, 79 St. George Street. Graduate nurses are in charge of both Infirmaries, and medical supervision is provided by the Health Service staff. These Infirmaries are intended for students with minor illnesses requiring bed care for a period of a few days to a week and are primarily for students in residence or lodgings for whom such care is not otherwise readily available. They are not intended for serious illness or injury requiring hospitalization for longer periods nor for students living at home where bed care is available. Students will be admitted to the Infirmaries on the authorization of the Director or Assistant-Director of the Health Service. While in the Infirmary, a charge of $1.50 per day, payable to the University Bursar, will be made to cover the cost of meals and routine medication.

8. The University Health Service will give a course of lectures to students of the First and Second Years on subjects related to the promotion and maintenance of health.

PHYSICAL TRAINING

9. By order of the Board of Governors, each man proceeding to a bachelor's degree must take physical training during the first and second years of his attendance at the University. The physical training requirements include a swimming test which must be taken by all first year men, by men admitted to the second year from other universities, and by those

repeating the first year. Before October 15th all first year students must make arrangements for a medical examination by the University Health Service at 43 St. George Street. All men required to take physical training must register with the Athletic Association in Hart House before October 15th. Men of second and higher years who wish to take part in any form of atheltics or physical training must first undergo a medical examination by the Health Service.

10. By order of the Board of Governors each woman proceeding to a Bachelor's degree must take Physical Training during the first year of her attendance at the university. Before October 10 in the session in which Physical Training is compulsory she must register for Physical Training at the gymnasium office, 153 Bloor Street West, and before October 15th apply for a medical examination by the University Health Service at 44 Hoskin Avenue. Swimming classes are compulsory for all students who do not pass the required swimming test. Students of all years who wish to take part in any form of athletics or physical exercise must first undergo a medical examination by the Health Service.

11. The student who has failed to complete satisfactorily attendance at the classes in Physical Training prescribed for the first year will not be permitted to register in the third year: and the student who has failed to complete satisfactorily attendance at the classes in Physical Training prescribed for the second year will not be permitted to register in the fourth year.

12. The student who has neglected to complete satisfactorily attendance at the classes in Physical Training of the first or second year must take this work during the second or third year respectively of his attendance at the University, and will be required to pay an additional supplemental fee of $10.00.

SECTION XV. HART HOUSE

Hart House, the gift of the Massey Foundation, is so called in memory of Mr. Hart Massey. This House, which is for the use of men only, is far more than a students' club. In its widest interpretation it seeks to provide for all the activities in the undergraduate's life apart from the actual work in the lecture room.

Hart House contains under one roof a dining hall, common-rooms, library, debates room, music room, a small chapel together with rooms for the use of the Student Christian Movement, an art gallery, an arts and crafts room, photographic rooms, billiard room, gymnasia, swimming pool, running track, rifle range, and theatre.

The House is open from 8 a.m. to 10.30 p.m. daily and meals are served to students in the Great Hall. Members are entitled to full privileges of all rooms in the building between these hours and the use of the gymnasia, pool, showers and locker rooms until 9.30 p.m. each day except Saturday and Sunday, subject to the regulations of the Athletic Association. On Saturday the pool, together with the rest of the athletic wing, closes at 5 p.m.

The Warden is entrusted with the general supervision of the whole House, but the athletic wing is under the direct control of the Athletic Directorate. In great measure the care of the House and its welfare are entrusted to the students themselves. There are a number of committees, most of which consist of ten undergraduates, three senior members, and the Warden. The undergraduates on all these committees are elected annually by the undergraduate members of Hart House. The undergraduate secretaries of six of these (House, Library, Music, Art, Debates, and Squash) together with certain appointed representatives, sit on the Board of Stewards or the governing board of the House which is directly responsible to the Governors of the University. Of this Board the Warden is ex-officio chairman. The Comptroller, the Assistant Comptroller, the Secretary, and the Assistant Secretary of Hart House are responsible for the administration.

All men undergraduates proceeding to a degree in the University are members of Hart House. The annual fee (September to May) is $12.00. To prevent the use of the building by unauthorized persons every member should carry his registration card and show it on request. Any member wishing to introduce a guest should obtain a card from the Warden's office.

Occasional students are not ordinarily eligible for membership in Hart House, but may make application to the Warden's office for election by the Membership Committee.

Graduate students, graduates resident in Toronto, and out of town graduates are entitled to the full privileges of Hart House when they have been duly elected and have paid the annual fee.

HART HOUSE THEATRE

Hart House Theatre is a repertory theatre existing to promote the interests of dramatic art in the widest sense. Its performances are open to members of the University and to the general public. The theatre is operated by a Board of Syndics, who are responsible to the Governors of the University for its administration. It is the policy of the Syndics to permit the rental of the theatre by those recognized dramatic societies within and outside the University which are endeavouring to do serious work.

On December 31st, 1942, owing to war conditions, the theatre was closed for all performances, though it was opened for a few weeks in the early winter of 1944 for University dramatic organizations.

THE SOLDIERS' TOWER

To commemorate the sacrifice of those graduates and undergraduates of our University who gave their lives in the Great War (1914-1918), the graduates have erected the Soldiers' Tower. Situated at the southwest corner of Hart House, the Tower rises—a symbol of sacrifice—and with its screen forms a majestic link between Hart House and the old Main Building. Beneath the sheltering arches of the screen, the names of the six hundred and eighteen, to whom the memorial pays its proud and affectionate tribute, are cut deep in the stone. Above, in the belfry of the Tower, is a carillon that, as it chimes, weaves a fabric of memories for professors and students who take up the tasks laid down by those who fell.

SECTION XVI. STUDENT ORGANIZATIONS

THE STUDENTS' ADMINISTRATIVE COUNCIL

The Students' Administrative Council is composed of the President or Head of the recognized men and women student organizations in each of the colleges, faculties and departments of the University, as outlined in Article 4 of the Constitution. The Students' Administrative Council assumes responsibility for the publication of *The Varsity*, *Torontonensis*, and the *Students' Handbook*. It represents the students at University functions and on public occasions, and receives and administers all funds accruing from Student Council fees, revenues from publications and such other funds as shall become the property of the Students' Administrative Council; and through its secretaries it organizes such intercollegiate and University activities as may be of interest to the student body as a whole.

The Council operates an employment bureau for men and women undergraduates for summer, Christmas, and part-time work; a housing service for men and women undergraduates; and a loan fund for men and women undergraduates in the final two years of their courses. Applications for loans must be made to the Students' Administrative Council's office; maximum loan $100. The sale of official University rings, pins, crests, etc., and orders for official blazers are also in the hands of the Council.

The annual fee paid by all undergraduates proceeding to a degree provides for a subscription to the publications of the Council to which the student is entitled, and makes available to them all services of the Council, including the loan fund to students in the final two years of their courses. The fee also covers administrative costs of the Students' Administrative Council.

UNIVERSITY OF TORONTO ATHLETIC ASSOCIATION

By the authority of the Board of Governors University athletics for men are under the control of the University of Toronto Athletic Association of which the executive body is the Athletic Directorate consisting of:

- the President of the University,
- two members of the faculty, appointed by the President,
- two graduates, appointed by the Athletic Advisory Board,
- the Director of University Health Service, the Athletic Director and the Financial Secretary (*ex-officio*),
- five undergraduates, elected annually, from the student body,
- an undergraduate representative, appointed by the Men Students' Administrative Council.

The Directorate, subject to the approval of the President, is empowered by the Board of Governors to control and administer the compulsory Physical Training programme required by the Board of all men under-

graduates during the first and second years of their attendance. The Directorate shall also control and administer the voluntary programme in Athletics and Physical Training available to men undergraduates of all years.

The Directorate alone has the power to sanction the use of the name "The University of Toronto" in connection with men's athletics, and no men's athletic event can be held in the University without its approval. It has full control and direction of the gymnasium, the swimming pool, the locker rooms, showers and other conveniences in connection with athletics in Hart House, the athletic fields, stadium and ice arena.

Subject to certain limitations, the annual athletic fee which is included in the incidental fees, provides for the opening of the gymnasium and swimming pool at nights, permits each student to attend home games of the University football and hockey teams, and offers other privileges such as skating at the outdoor rink and affiliation with golf, riding and ski-ing clubs, etc.

UNIVERSITY OF TORONTO WOMEN'S ATHLETIC ASSOCIATION

By the authority of the Board of Governors University athletics for women are under the control of the University of Toronto Women's Athletic Association of which the executive body is the Women's Athletic Directorate consisting of:

- the President of the University,
- two women members of the faculty, appointed by the President,
- two women graduates, elected by the Women's Athletic Advisory Board,
- the Assistant Director of University Health Service in charge of Women, the Physical Director for Women, and the Financial Secretary (*ex-officio*),
- five women undergraduates, elected annually,
- one woman undergraduate, appointed by the Students' Administrative Council.

The Directorate, subject to the approval of the President and the Physical Director for Women, is empowered by the Board of Governors to control and administer the compulsory Physical Training programme required by the Board of certain women undergraduates during the first year of their attendance. The Directorate shall also control and administer the voluntary programme in Athletics and Physical Training available to women undergraduates of all years.

The Directorate alone has the power to sanction the use of the name "The University of Toronto" in connection with women's athletics, and no athletic event for women may be held in the University without its approval.

Subject to certain limitations, the annual athletic fee which is included in the incidental fees, permits each student to attend home games of the

University football and hockey teams, and offers other privileges such as skating at the outdoor rink and affiliation with golf, riding and ski-ing clubs, etc.

UNIVERSITY OF TORONTO ENGINEERING SOCIETY

The objects of the Engineering Society as set forth in its constitution are:

(*a*) The encouragement of original research in Engineering.
(*b*) The preservation of the results of such research.
(*c*) The dissemination of these results among its members.
(*d*) The cultivation of the spirit of mutual assistance and co-operation among the members of the Society in the preparation for, and in the practice of, the profession of Engineering.
(*e*) To afford an official means of communication between the Student body and the Faculty Council, the University authorities, and the students of other Faculties.

For purposes of organization the Engineering Society consists of a federation of the Clubs named as follows:

(*a*) The Civil Club of the Engineering Society, composed of the undergraduates in Civil Engineering.
(*b*) The Mining and Metallurgical Club of the Engineering Society, composed of the undergraduates in Mining Engineering, Metallurgical Engineering and Mining Geology.
(*e*) The Mechanical Club of the Engineering Society, composed of the undergraduates in Mechanical Engineering.
(*d*) The Electrical Club of the Engineering Society, composed of the undergraduates in Electrical Engineering.
(*e*) The Architectural Club of the Engineering Society, composed of the undergraduates in Architecture.
(*f*) The Industrial Chemical Club of the Engineering Society, composed of the undergraduates in Chemical Engineering.
(*g*) The Engineering Physics Club of the Engineering Society, composed of the undergraduates in Engineering Physics.
(*h*) The Debating Club of the Engineering Society, composed of the undergraduates in all Departments.

These Clubs devote themselves to subjects of special interest to their members. Each Club holds meetings at regular intervals, when papers are read, and discussions on technical subjects take place.

The Society meets during the academic year (except in April). Addresses are given by prominent men on subjects of general interest.

The Society publishes an annual, called "Transactions", which contains addresses given at the meetings and an account of the year's activities.

A Supply Department is conducted by the Society on a co-operative plan, through which instruments, draughting supplies, stationery, and other supplies, can be purchased.

FACULTY OF APPLIED SCIENCE ATHLETIC ASSOCIATION

Affiliated with the Engineering Society is the Faculty of Applied Science Athletic Association.

The Athletic Association has full control over all athletic clubs using the name of the Faculty of Applied Science. The Executive Committee has power to suspend anyone from the privileges of membership in the Association for any breach of its regulations, and controls the finances of all athletic clubs in the aforesaid Faculty. The annual membership fee of this Association is two dollars.

No other moneys are collected for the support of athletics in the Faculty of Applied Science without the sanction of the Executive Committee.

STUDENT CHRISTIAN MOVEMENT

The Student Christian Movement in the University of Toronto is part of an international fellowship of students in the colleges and universities of the world, the World's Student Christian Federation.

It is a fellowship, based on the conviction that in Jesus Christ are to be found the supreme revelation of God and the means to the full realization of life. It seeks, through study, prayer, and practice, to understand the Christian faith and to live the Christian life by uniting in its fellowship all students who share its basic convictions as well as those who wish to test their truth.

Among the methods employed by the Movement in seeking to realize its purpose are study groups, worship services, forum discussions, conferences, lectures, and social services in the downtown district. It is not necessary to "join" in order to share in the programme of the Movement. Its activities are open to all.

Full information may be obtained from the S.C.M. executives in the various colleges, the names of whom will be found in the *Students' Handbook*, or from the General Secretary of the S.C.M., in Hart House.

VARSITY CHRISTIAN FELLOWSHIP

The Engineering Branch of the Varsity Christian Fellowship is affiliated with the campus-wide Varsity Christian Fellowship which in turn is a part of the world-wide Inter-Varsity Christian Fellowship.

The Fellowship is founded on the historic fact that God has revealed Himself in the life, death, and resurrection of His Son, Jesus Christ; that personal faith in Him results in the forgiveness of sin, victory over sin, and a new joyful life purpose. The Fellowship is seeking to bear witness to the vitality of this faith and to the power of the Saviour in every relationship of life.

Through the activities, which are open to all undergraduates, it seeks to show the applicability of these principles to an individual in business or professional life.

These activities embrace (*a*) daily prayer meetings at 8.15 a.m. in Hart House Chapel, (*b*) weekly noon-hour meetings on Tuesdays and (*c*) special events such as dinners, firesides, and sing songs. The officers are listed in the *Students' Handbook* and announcements are made in the ***Varsity.***

UNIVERSITY OF TORONTO
UNIVERSITY NAVAL TRAINING DIVISION

The University Naval Training Division (U.N.T.D.) was formed in the spring of 1943 by Naval Service Headquarters, the primary purpose being to prepare students for eventual service with the Royal Canadian Naval Volunteer Reserve. It is felt by Naval Service Headquarters that the training received in the University Naval Training Division will be of great assistance to students both while attending University and upon reporting for active service with the Royal Canadian Naval Volunteer Reserve.

Students enrolled in the U.N.T.D. are attested on Divisional Strength in the R.C.N.V.R., that is, they are enrolled for the duration of hostilities (unlike men of the Royal Canadian Navy, who are enrolled for seven years' service), and are available for active service at any time. However, active service call for all students enrolled in the U.N.T.D. will be delayed, subject to the exigencies of the Service, until the students graduate or cease to attend university.

In the session 1944-1945 there were approximately 281 U.N.T.D. students on Divisional Strength of the R.C.N.V.R. at the University of Toronto, of which number 151 were serving their first year of Naval Training, the balance their second year.

Students enrolled in the U.N.T.D. of the University of Toronto are part of the complement of H.M.C.S. "York", and their administration, training, and discipline, are under the Commanding Officer, H.M.C.S. "York".

While enrolled in the U.N.T.D. students wear uniforms similar to those of corresponding rate in the R.C.N. Students may wear their uniforms only on parade days.

Students in Mechanical Engineering, Electrical Engineering, Engineering Physics, and honour Mathematics and Physics courses are enrolled as Stokers Second Class. Those in other university courses, except Medical and Dental students, are enrolled as Ordinary Seamen. Medical and Dental students cannot be enrolled in the U.N.T.D., as they are under control of the Army for training.

U.N.T.D. students are given a minimum of 110 hours' training during their academic year, and a minimum of two weeks' training with active service pay at either coast during the summer months. The syllabus of training is progressive from year to year, and covers the basic training given to active service ratings in Divisional Establishments, including

Seamanship, Rifle Drill, Visual Signalling, and lectures on Naval Regulations. No examinations are involved.

The Ship's Office of the U.N.T.D. is located in Room "A" at Hart House, telephone MIdway 1958, with the following in charge:

Area Commanding Officer...A/Commander J. J. Connolly, R.C.N.V.R.
Commanding Officer........Lieut.-Commander (SB) D. A. F. Robinson, R.C.N.V.R.
Divisional Officers..........Lieut. C. C. McGibbon, R.C.N.V.R.
Lieut. L. Hynes, R.C.N.V.R.

UNIVERSITY OF TORONTO CONTINGENT CANADIAN OFFICERS TRAINING CORPS

The functions of the University of Toronto Contingent of the Canadian Officers' Training Corps is to provide military training for undergraduates while attending the University, and to recommend potential officer candidates in the various arms to proceed to advanced Training Centres for further training.

To enable undergraduates to pursue their academic studies the Government has authorized the postponement of their calls for military training under the N.R.M.A. provided they are receiving training with the Contingent or other units of the Armed Forces.

Students who have undergone one year's training in the Second Battalion or who have had the equivalent of one annual training in a Reserve Army unit are members of the First Battalion. These students receive additional basic training and special to Arm training in Artillery, Engineers, Electrical Mechanical Engineers, Signals, Infantry, Armoured Corps and Army Service. These students, as well as the N.C.O's. of the Second Battalion, are eligible to be recommended as potential officer candidates, Active Army, if they come up to the standard required.

Students who have not received the equivalent of one annual training with a Reserve Army unit are members of the Second Battalion of the Contingent where they receive basic training common to all arms of the service.

Contingent Headquarters are situated at 119 St. George Street. Accommodation includes drill hall, arms room, Q.M. Stores, and lecture rooms. First Battalion Headquarters is also at 119 St. George Street. Second Battalion Headquarters is in Hart House.

The Contingent staff for the session 1944-1945 was:

Contingent Headquarters

Honorary Colonel..........Colonel H. J. Cody, C.M.G., E.D.
Commanding Officer........Lieut.-Col. W. S. Wilson, E.D.
Second-in-Command........Major M. B. Watson, E.D., m.s.c.
Quartermaster.............Capt. C. A. Johnston
Medical Officer............Major J. L. McCollum, R.C.A.M.C.
Chaplain.................Hon. Capt. W. C. Lockhart, C.C.S.

First Battalion

Commanding Officer........Lieut.-Col. W. S. Wilson, E.D.
Chief Instructor...........Major M. B. Watson, E.D., m.s.c.
Training Officer...........Capt. E. L. Gibson
Adjutant..................Major H. C. H. Miller
Assistant Adjutant.........Lieut. D. A. McIver
Medical Officer............Capt. H. A. Burnett, R.C.A.M.C.

Second Battalion

Acting Commanding Officer..Major F. R. Crocombe
Chief Instructor...........Major G. R. Lane
Adjutant..................Capt. J. C. Evans
Medical Officer............Capt. D. L. Selby, R.C.A.M.C.

SECTION XVII. LODGING AND BOARD

GENERAL

For students who are not accommodated in the University and College residences, the Students' Administrative Council prepares annually a list of inspected and approved rooming houses. This list may be consulted at the office in Hart House two weeks prior to the opening of the Michaelmas term and throughout the session.

RESIDENCE FOR MEN

Through the generosity of the late E. C. Whitney, Esq., Mrs. Whitney, and friends, the University offers to approximately one hundred and fifty men the advantages of residential life within its own grounds. The Residence consists of three Houses: South, East and North.

The regular rates are $3.25 a week for a single room or half of a suite (two bedrooms and common study). For men holding admission or undergraduate scholarships, for first class honour men in the Faculty of Arts, and for honour men in the other faculties, the rates are $3.00 a week. An occupant entitled to the lower rate must, when paying his rent, submit to the Bursar the evidence that he has the required standing. A student of the Faculty of Arts requiring this evidence may obtain it in the form of a certificate from the University Registrar, Simcoe Hall; a student of any other Faculty may obtain it from the Secretary of his Faculty.

Except under very special circumstances, occupants will be required to remain in the Residence for the full academic session. Occupants who obtain permission to withdraw will be required to give two weeks' notice and to forfeit their deposits.

Applications for rooms must be submitted to the Secretary of the Residence Committee, Registrar's Office, Simcoe Hall. Forms for this purpose will be supplied on request. Each application must be accompanied by a deposit of $5.00. This deposit will be returned if the applicant is not admitted, but will be forfeited if written notice of non-acceptance of a room assigned is not received by the Secretary before September 15th. If such notification is not received until after the opening of the session, the applicant will forfeit his deposit and will be required to pay a penalty of two weeks' room rent. On request the deposit will be refunded in full at the end of the college year if the room key is returned and the room and furniture left in a satisfactory condition.

The University lays down three general rules designed to prevent hazing, gambling, and the use of intoxicants.

A circular giving further information may be obtained from the Secretary of the Residence Committee.

SUMMARY OF STUDENTS IN ATTENDANCE

Session 1944-45

	Department											
Year	1	2	3	4	5	6	7	8	8a	9	10	Total
I	76	6	69	24	44	100	76	8	8	3	24	438
II	28	3	45	5	23	49	41	5	..	2	14	215
III	52	1	70	9	22	51	48	14	4	1	11	283
IV	31	6	62	5	18	42	50	12	4	2	2	234
V	..	..	..	3	..	..	..	..	..	..	..	3
	187	16	246	46	107	242	215	39	16	8	51	1,173

For graduate students, see p. 200

SECTION XVIII. THE ENGINEERING ALUMNI ASSOCIATION

This calendar presents in outline the courses offered in the Faculty of Applied Science and Engineering, as well as an indication of opportunities which are open to undergraduates for a broadening of their interests by participation in the extra-curricular activities of the Faculty and University.

After spending a few years under the stimulating and maturing influence of college life it is natural that students should, after graduation, feel a desire to preserve the friendships formed in undergraduate days, and should seek to extend the opportunity for further interest and service on behalf of Faculty and Alma Mater.

Many Engineering graduates, who recall their college days with pleasure and a sense of indebtedness, have felt this desire which has found expression in the formation of the Engineering Alumni Association. With succeeding years of mellowing traditions and fresh infusions of new members annually, it has grown in enthusiasm as well as in size. Each graduating class appoints its own permanent executive, thus retaining its identity and through the inspiration and leadership of the Engineering Alumni Association all find a common bond of loyalty to "School" and its traditions, and a friendly contact with their fellows.

Every three years a reunion of "School" graduates is held to bring them together for a renewal of old associations with classmates and with staff. Between times the Association carries on its work through its Council. The extent of these activities is well exemplified by naming such council committees as Membership, Scholarship, Class Organizations, Undergraduate Relations, Engineering Education, Reunions, Publicity, and Federation Affairs. Certain members of the Council are constituted as a Junior Panel and maintain close relations with the more recent graduates, while the inclusion of the President of the Engineering Society on the Council ensures liaison with the undergraduate body.

The Engineering Alumni Association serves in the wider sphere of University graduate activities through its membership in the Alumni Federation of the University of Toronto, which was formed from seventeen associations representing various Colleges, Faculties, and Departments in the University. The Federation co-ordinates the activity of all the Associations and edits and publishes the *University of Toronto Monthly*, which contains news items and articles of interest to all graduates. Through Class, Association and Federation the bond is complete and "School" men take pride in the extent to which they have contributed of their counsel and support on such matters as the University and the Faculty may wish to consult the graduate body.

All "School" graduates, and students who have had at least one year in the Faculty of Applied Science and Engineering, are members of the

Engineering Alumni Association and the Alumni Federation; but only those paying the prescribed annual fee of three dollars are entitled to vote, hold office, or exercise the rights and privileges of membership and to receive the *University of Toronto Monthly*. This fee is distributed—one dollar to the Engineering Alumni Association for the maintenance of its activities, and two dollars to the Alumni Federation towards a share of its administrative expenses and for clerical work on behalf of the Association, and to cover the members' subscription to the *University of Toronto Monthly*.

APPENDIX I. GRADUATE STUDIES

Graduates interested in pursuing courses for post-graduate degrees should send inquiries to the Secretary of the School of Graduate Studies.

The University is prepared to offer graduate courses in all of the Departments of the Faculty of Applied Science and Engineering. The degrees offered are M.A.Sc., M.Arch., and Ph.D. These courses are open to graduates of this University or of another University of comparable standing. Candidates must have a sufficiently good undergraduate record in a course closely related to the one they propose to follow.

Various Fellowships, Bursaries, and Scholarships are available to graduate students as shown in the table on page 149. In time of peace many part-time demonstratorships are open which permit graduate work towards a degree. In normal times, also, research assistants are appointed annually on salary in the School of Engineering Research, and this work may be counted as a partial fulfilment of the requirements for a graduate degree.

One full academic year of study is required for the degree of M.A.Sc. and M.Arch. and a minimum of three years for the degree of Ph.D. Part-time work must total to these full-time requirements. To be eligible to receive the degree of Ph.D. the candidate must make an original contribution to knowledge.

REGULATIONS FOR DEGREES

MASTER OF APPLIED SCIENCE, MASTER OF ARCHITECTURE

The regulations governing the Degrees of Master of Applied Science (M.A.Sc.) and Master of Architecture (M.Arch.) shall be determined as follows:

1*a*. A candidate for the degree of Master of Applied Science shall hold the degree of Bachelor of Applied Science of this University or a degree from some other university recognized as equivalent by the Council of the School of Graduate Studies.

1*b*. A candidate for the degree of Master of Architecture shall hold the degree of Bachelor of Architecture or the degree of Bachelor of Applied Science in Architecture of this University or a degree from some other university recognized as equivalent by the Council of the School of Graduate Studies.

2. A candidate wishing to proceed to a graduate degree shall (*a*) register with the Secretary of the School of Graduate Studies at the beginning of the academic year, (*b*) enrol in one of the courses mentioned in Clause 4. As a condition of registration as a candidate proceeding to a degree, he must submit evidence that the department concerned is willing to enrol him.

3. Not later than November 1, 1945, he shall submit to the Secretary

for acceptance by the Council of the School of Graduate Studies the title of his proposed thesis as approved by the department concerned.

4. Not later than May 15, 1946, he shall present evidence to the Council of the School of Graduate Studies that he has spent not less than one academic year in the course concerned as a student enrolled in one of the following courses on a course of study approved by the department: Civil Engineering, Mining Engineering, Mechanical Engineering, Architecture, Engineering Physics, Chemical Engineering, Electrical Engineering, Metallurgical Engineering, Mining Geology, Aeronautical Engineering.

5. Not later than May 15, 1946, evidence that the candidate has satisfactorily met all the requirements of the department with regard to thesis and to such examinations as the department shall require, shall be forwarded to the Council of the School of Graduate Studies through the sub-committee administering the regulations governing the degrees of Master of Applied Science and Master of Architecture.

DOCTOR OF PHILOSOPHY

Graduates of the Faculty of Applied Science and Engineering may proceed to the degree of Doctor of Philosophy. Information as to the conditions to be met by candidates for this degree is to be found in the Calendar of the School of Graduate Studies, which may be obtained from the Registrar of the University. The degree is an academic degree, not a professional one, and the research work and courses leading to the degree are primarily concerned with the fundamentals and underlying principles of the sciences. In general, a candidate selects one major and two minor subjects for study, the research being carried out in the major subject. A period of three years is usually required for the fulfilment of the requirements for the degree. However, it should be understood that the degree is not granted for the passing of prescribed courses or for the performance of prescribed laboratory work for a period of three years. The laboratory research work must have led to results of a high order, constituting a real contribution to the science of the major subject, and the candidate must have attained a decided maturity of knowledge and outlook before he may present himself for final examination by the Committee of the School of Graduate Studies. A graduate proposing to proceed to this degree should consult, in the first instance, with the members of the staff in the department in which he proposes to take his major subject.

PROFESSIONAL DEGREES

CIVIL ENGINEER, MINING ENGINEER, MECHANICAL ENGINEER, ELECTRICAL ENGINEER, CHEMICAL ENGINEER, METALLURGICAL ENGINEER

The regulations governing the Professional Degrees of Civil Engineer (C.E.), Mining Engineer (M.E.), Mechanical Engineer (Mech.E.), Elec-

trical Engineer (E.E.), Chemical Engineer (Chem.E.), Metallurgical Engineer (Met.E.), for the session 1945-46 shall be determined as follows:

1. A candidate for one of the said degrees shall hold the diploma of the School of Practical Science or of the Faculty of Applied Science and Engineering or the degree of Bachelor of Applied Science, or shall have spent not less than two years as a member of the teaching staff in this Faculty after having graduated in engineering from another institution of recognized reputation.

2. He shall have spent at least three years after receiving the diploma or the degree in the actual practice of the branch of engineering wherein he is a candidate for a degree.

3. Intervals of non-employment, or of employment in other branches of engineering, shall not be included in the above three years. It shall not be necessary that the several periods requisite to make up the said three years be consecutive.

4. The candidate shall obtain from the Secretary of the School of Graduate Studies the regular application form which, properly filled out, accompanied by the designated evidence of professional experience and by the title and synopsis of the proposed thesis, shall be delivered to the Secretary not later than the first day of November.

The evidence of professional experience shall fully describe the kind and extent of all work undertaken by the candidate since the date of graduation up to the time of application, indicating clearly the degree of responsibility for such work. Certificates from present and past employers shall accompany the application. The names and addresses of not less than five engineers to whom the candidate is personally known and who have knowledge of his professional activities shall be submitted.

5. The application and the subject of the thesis are subject to the approval of the Board of Examiners, who may satisfy themselves by oral or written examinations in regard to the candidate's experience and competence in engineering works.

6. The candidate after notification of the approval of the Board shall prepare an original engineering thesis in the branch in which he has applied for a degree. This thesis shall be on work in which the candidate has had actual experience and shall preferably be in the form of an engineer's report on the design of engineering works, or on processes, and accompanied by all necessary descriptions, details, drawings, bills of materials, specifications and estimates. (Note that a thesis of a solely descriptive type will not be acceptable.)

7. The thesis, with accompanying papers, described in clause 6, shall be sent to the Secretary not later than the first day of March.

8. The candidate may be required to present himself for examination in the months of March or April at such time as may be arranged by the Examiners.

9. The thesis, drawings and other papers submitted under clause 7, shall become the property of the University.

10. Nothing in these regulations shall prevent any candidate from receiving more than one of the said degrees, provided he has the necessary qualifications for each degree. An interval of three years must elapse between the granting of any two degrees under these regulations.

HIGH SCHOOL ASSISTANTS' CERTIFICATES

The Department of Education of Ontario has agreed to accept the degree of Bachelor of Applied Science as fulfilling the academic requirement for admission to the course for a High School Assistants' Certificate in the Ontario College of Education.

SPECIALISTS' CERTIFICATES

By an agreement between the University of Toronto and the Department of Education of Ontario, persons holding the degree of Bachelor of Applied Science may, by taking certain prescribed courses in the Faculty of Arts, complete the academic requirements for admission to the qualifying examination for specialist courses in (*a*) Mathematics and Physics and (*b*) Science, at the Ontario College of Education. Information regarding these prescribed courses may be obtained from a pamphlet issued by the Registrar of the University, from whom copies may be had on application. Each person who desires to complete these academic requirements should communicate directly with the Registrar in order that his case may be considered and his particular conditions defined.

The Department of Education has approved of the acceptance of the degree in Applied Science in the Course in Engineering Physics, with standing of at least 60% at the final examination, as covering the academic requirements for admission to the qualifying examination for the Specialists' course in Mathematics and Physics at the Ontario College of Education.

ONTARIO LAND SURVEYORS AND DOMINION LAND SURVEYORS

Examinations are held usually in February of each year, for the following:

Preliminary Dominion Land Surveyors
Leveller's Examination
Final Dominion Land Surveyors
Ontario Land Surveyors

Any student of the Faculty of Applied Science and Engineering is eligible for these examinations, but graduates in Civil and Mining Engineering are allowed a shortened apprenticeship before writing their final examinations. Full information respecting above examinations may be obtained from the staff in Surveying and Geodesy.

GRADUATES ENROLLED IN THE FACULTY OF APPLIED SCIENCE AND ENGINEERING

Engineering Physics	3
Chemical Engineering	12
Metallurgical Engineering	3
Total	18

APPENDIX II. POST-DISCHARGE RE-ESTABLISHMENT

SUMMARY OF TRAINING PROVISIONS OF THE POST-DISCHARGE RE-ESTABLISHMENT ORDER, P.C. 5210

DEPARTMENT OF VETERANS AFFAIRS

November 1, 1944

UNIVERSITY TRAINING

I. *Under-graduate—(Para. 8, P.C. 5210)*

The Minister has authority to approve training, including maintenance grant and fees—together with appropriate allowances for dependents—for any discharged person who has the aptitude and inclination and who:

(*a*) has been regularly admitted to a university before his discharge and resumes within one year and three months after discharge a course, academic or professional, interrupted by his service, or

(*b*) becomes regularly admitted to a university and commences any such course within one year and three months after his discharge, or

(*c*) because of ill health or because his admission to the university has been conditional upon his fulfilling some additional matriculation requirements or for any other good reason shown to the satisfaction of the Department, delays resumption or commencement of such course beyond the aforementioned periods.

The period of assistance in university training is governed by the length of service. *Where progress is satisfactory the assistance may be continued for as many months, in university, as the man served in the Forces.* If the student's progress and *attainments* in his course are such that the Department deems it in his interest and in the public interest, the payment of the grant may be extended beyond the period of service to permit the man to complete his course.

However, the grant shall not be continued to any such person who fails in more than two classes or subjects in any academic year, nor to any such person who having failed in either one or two classes or subjects also fails in either or both supplementary examinations next offered by the university in such classes or subjects.

NOTE: "*Attainments*" means unconditioned standing in the top 25% (first quartile) of his class on the final examinations on the full work of the year next preceding the year in which his period of entitlement expires.

II. *Post-graduate—(Para. 9, P.C. 5210)*

In case any discharged person

(*a*) *has entered upon a post-graduate course, either academic or professional, in a university before enlistment, or was about to do so at the time of his enlistment*, or, having completed his under-graduate course in a university after his discharge, enters upon a post-graduate course as aforesaid, and

(*b*) resumes or commences such post-graduate course within

(i) one year from his discharge, or

(ii) one year from the commencement, next following his discharge, of such course in such university, if his discharge precedes such commencement by not more than three months, or

(iii) in the case of a discharged person who completes his under-graduate course after his discharge, as soon as may be after such completion,

if the Department, having considered such person's attainments and his course, deems it in the public interest that he should continue such course, the Department may, subject to the provisions of this Order, authorize the payment to such person ot a maintenance grant and fees for as many months as he served. The assistance may be extended if the progress and *achievements* are so outstanding that it is in the public interest that the grant should be continued.

A candidate with a first degree, B.A., B.Sc., M.D., D.D.S., etc., who applies for further training, academic or professional, in his special field, shall be considered under Paragraph 9, Post-graduate Training.

Where a first degree is required for admission to a professional training school, or faculty, a candidate for such professional training shall be considered under Paragraph 8, Under-graduate Training.

Vocational, Technical, or Other Educational Training—Para. 6, P.C. 5210

The Department has authority to approve training, including maintenance grant and fees—together with appropriate allowances for dependents—to any discharged person, provided he has the aptitude and inclination, where such person is pursuing vocational, technical or other educational training; where the Department approves such training as being training which will fit him or keep him fit for employment or re-employment or will enable him to obtain better or more suitable employment; and where he makes progress in such training to the satisfaction of the Department.

'*Other Educational Training*' provides for

(1) Resumption of education leading to high school graduation or matriculation, where such training is pre-requisite to employment or professional training.

(2) 'Refresher' or 'brush-up' courses in the professions.

NOTE: The period of training is governed by the length of service. For most types of training the maximum will be twelve months. In instances where the required training exceeds twelve months grants may be continued for a period not exceeding the length of service. In no case shall grants be paid beyond the period of service except in the case of disability pensioner.

Maintenance Grants

Where the discharged non-pensioner is in full-time training, the basic maintenance grant for a single person is $60.00 per month; married person $80.00 per month, *subject to reduction by such amount on account of any wages, salary or other income such person may have received or be entitled to receive in respect of the period for which such grant is paid, as to the Department seems right.* Appropriate allowances may be paid on behalf of dependents.

INDEX

Administrative Officers.... 7
Admission, Qualifications and Procedure for.... 17
Aerodynamic Laboratory.... 175
Aeronautical Engineering....23, 66, 72
Alternating Current Machine Laboratory.... 171
Alumni Association.... 194
Annual Examinations.... 147
Applied Mathematics.... 129
Applied Mechanics.... 74
Applied Physics.... 80
Applied Physics Laboratories.... 173
Architecture.... 83
Architecture, School of....23, 38
Assaying.... 89
Assaying Laboratory.... 166
Astronomy.... 93
Athletic Association....185, 186
Attendance, Summary of Students in....193, 200

Bachelor Degrees.... 23
Botany.... 94
Bursaries.... 149
Business Administration.... 103

Calendar.... 5
Canadian Officers' Training Corps.... 190
Cement Laboratory.... 164
Ceramics and Non-*M*etallic *M*inerals.... 132
Chemical Engineering....23, 49, 95
Chemical Engineering Laboratories.... 170
Chemistry.... 95
Civil Engineering....23, 27, 94
Civil Engineering Laboratories.... 164
Commencement.... 6
Communication Laboratory.... 172
Communication....44, 46
Conduct of Students.... 178
Constitution, Student Societies.... 185
Courses.... 23
Courses, Graduating....23, 26
Curriculum.... 26

Degrees.... 23
- Bachelor.... 23
- Master....23, 196
- Professional....24, 197
- Ph.D....23, 197

Departmental Libraries.... 164
Department of Health Laboratory.... 175
Deposits.... 21
Descriptive Geometry.... 100
Design of Structures.... 74
Direct Current Machine Laboratory.... 171
Discipline.... 178
Dominion Land Surveyors.... 199
Drawing....83, 100

Economics 103
Electrical Engineering 23, 53
Electrical Engineering Laboratories 171
Electrical Measurements Laboratory 172
Electricity 107
Electricity and Communication 44, 46
Electrochemical Laboratories 176
Engineering Alumni Association 194
Engineering and Business 23, 69
Engineering Problems and Drawing 100
Engineering Physics 23, 42
Engineering Research, School of 25
Engineering Society 187
English 135
Examinations 147
Excursions 26
Ex-Service Personnel 128

Fees 21

Geodesy 93
Geological Laboratories 176
Geology 114
Geophysics 44, 47
German 135
Graduate Studies 196
Graduating Courses 23, 26

Hart House 183
Heat Engine Laboratory 168
Heat Engines 117
High School Assistants' Certificates 199
Highway Laboratory 165
Historical Sketch 16
Holidays 5
Hydraulic Laboratory 169
Hydraulics 120
Hydrostatics 120

Illumination and Acoustics 44, 48
Inquiries 7

Laboratories 164
Languages 135
Law 103
Lecture and Laboratory Subjects 72
Libraries 164
Loan Funds 149
Lodging and Board 192

Machinery 123
Masters Degrees 196
Mathematics 126
Mechanical Engineering 23, 35
Mechanical Engineering Laboratories 168
Mechanics 74
Mechanics of Materials Laboratory 165

Meetings, Engineering Society.... 5
Medals.... 149
Metallurgy.... 129
Metallurgical Engineering....23, 57
Metallurgical Engineering Laboratories.... 172
Metrological Laboratory.... 175
Mineralogical Laboratories.... 177
Mineralogy.... 133
Mining.... 89
Mining Engineering....23, 31
Mining Geology....23, 62
Mining Engineering Laboratories.... 166
Modern Languages.... 135
Municipal Engineering.... 134
Museum, Royal Ontario.... 177

Naval Training Division, University.... 189
Non-Metallic Minerals.... 132

Officers, Administrative.... 7
Officers' Training Corps, Canadian.... 190
Ontario Department of Health Laboratory.... 175
Ontario Land Surveyors.... 199
Ore Dressing.... 89
Ore Dressing Laboratory.... 167

Painting.... 83
Ph.D.... 197
Photographic Laboratory.... 170
Physical Training....22, 135, 181
Physics, Applied.... 80
Physics.... 135
Post-Discharge Re-establishment.... 201
Practical Experience.... 140
Professional Degrees.... 197
Prizes.... 149

Registration....5, 17, 19
Research Assistants.... 25
Research, School of Engineering.... 25
Residences.... 192

Sanitary Engineering Laboratory.... 175
School of Architecture....23, 38
School of Engineering Research.... 25
School of Graduate Studies.... 196
Scholarships.... 149
Shop Work....35, 140
Sickness.... 147
Soil Mechanics Laboratory.... 165
Soldiers' Tower.... 184
Specialists' Certificates.... 199
Spectroscopy....44, 46
Staff, Teaching.... 8
Structures, Design of.... 74
Student Christian Movement.... 188
Students' Administrative Council.... 185

Student Organizations.... 185
Supplemental Examinations.... 148
Summary of Students in Attendance....193, 200
Surveying.... 142
Survey Camp....5, 144, 174

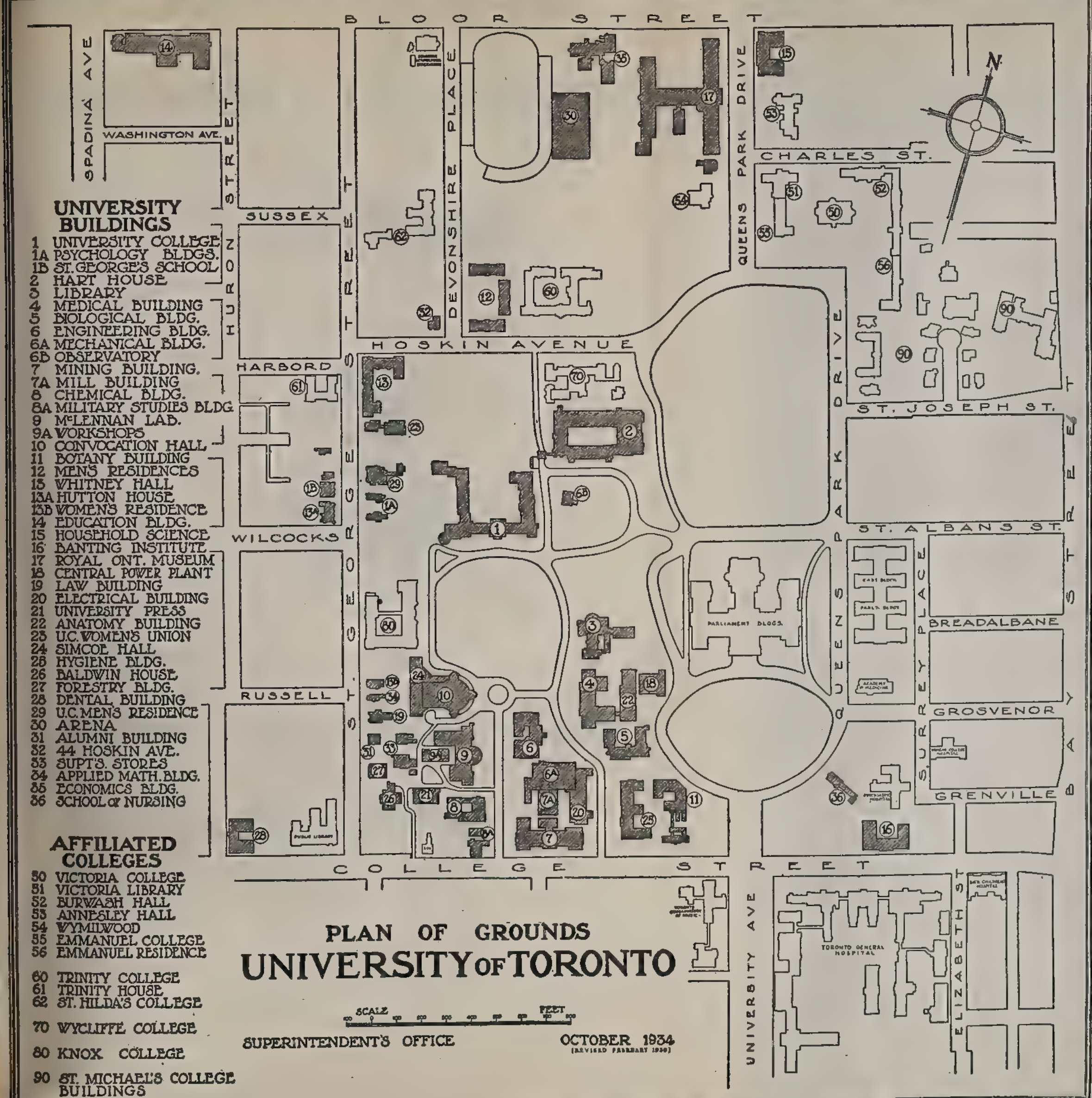
Teachers' Certificates.... 199
Term Examinations.... 148
Theatre, Hart House.... 184
Thesis.... 144

University Health Service.... 180
University Naval Training Division.... 189
University Survey Camp.... 174

Vaccination.... 19

X-Rays and Spectroscopy....44, 46

Zymology.... 146



PLAN OF GROUNDS
UNIVERSITY OF TORONTO
SUPERINTENDENT'S OFFICE
OCTOBER 1934
SCALE
FEET
UNIVERSITY BUILDINGS
1 UNIVERSITY COLLEGE
1A PSYCHOLOGY BLDGS.
1B ST. GEORGE'S SCHOOL
2 HART HOUSE
3 LIBRARY
4 MEDICAL BUILDING
5 BIOLOGICAL BLDG.
6 ENGINEERING BLDG.
6A MECHANICAL BLDG.
6B OBSERVATORY
7 MINING BUILDING.
7A MILL BUILDING
8 CHEMICAL BLDG.
8A MILITARY STUDIES BLDG.
9 McLENNAN LAB.
9A WORKSHOPS
10 CONVOCATION HALL
11 BOTANY BUILDING
12 MEN'S RESIDENCES
13 WHITNEY HALL
13A HUTTON HOUSE
13B WOMEN'S RESIDENCE
14 EDUCATION BLDG.
15 HOUSEHOLD SCIENCE
16 BANTING INSTITUTE
17 ROYAL ONT. MUSEUM
18 CENTRAL POWER PLANT
19 LAW BUILDING
20 ELECTRICAL BUILDING
21 UNIVERSITY PRESS
22 ANATOMY BUILDING
23 U.C. WOMEN'S UNION
24 SIMCOE HALL
25 HYGIENE BLDG.
26 BALDWIN HOUSE
27 FORESTRY BLDG.
28 DENTAL BUILDING
29 U.C. MEN'S RESIDENCE
30 ARENA
31 ALUMNI BUILDING
32 44 HOSKIN AVE.
33 SUPT'S. STORES
34 APPLIED MATH. BLDG.
35 ECONOMICS BLDG.
36 SCHOOL OF NURSING
AFFILIATED COLLEGES
50 VICTORIA COLLEGE
51 VICTORIA LIBRARY
52 BURWASH HALL
53 ANNESLEY HALL
54 WYMILWOOD
55 EMMANUEL COLLEGE
56 EMMANUEL RESIDENCE
60 TRINITY COLLEGE
61 TRINITY HOUSE
62 ST. HILDA'S COLLEGE
70 WYCLIFFE COLLEGE
80 KNOX COLLEGE
90 ST. MICHAEL'S COLLEGE BUILDINGS
BLOOR STREET
COLLEGE STREET
SPADINA AVE
WASHINGTON AVE.
HURON STREET
SUSSEX
HARBORD
WILCOCKS
RUSSELL
ST. GEORGE STREET
DEVONSHIRE PLACE
HOSKIN AVENUE
QUEENS PARK DRIVE
CHARLES ST.
ST. JOSEPH ST.
ST. ALBANS ST.
BREADALBANE
GROSVENOR
GRENVILLE
SURREY PLACE
BAY STREET
UNIVERSITY AVE
ELIZABETH ST
PARLIAMENT BLDGS.
TORONTO GENERAL HOSPITAL
N

UNIVERSITY OF TORONTO

CALENDAR

FACULTY OF APPLIED SCIENCE
AND
ENGINEERING

1946-1947

THE UNIVERSITY OF TORONTO PRESS
1946

CONTENTS

			Page
SECTION	I.	Calendar	5
"	II.	Administrative Officers	7
"	III.	Teaching Staff	8
"	IV.	Historical Sketch	20
"	V.	Admission and Registration	21
"	VI.	Fees, Deposits and Expenses	25
"	VII.	Courses and Degrees	28
"	VIII.	School of Engineering Research	30
"	IX.	Curriculum	31
"	X.	Examinations	153
"	XI.	Scholarships	155
"	XII.	Libraries and Laboratories	175
"	XIII.	Discipline	190
"	XIV.	University Health Service and Physical Training	192
"	XV.	Hart House	197
"	XVI.	Student Organizations	200
"	XVII.	Lodging and Board	208
"	XVIII.	Engineering Alumni Association	211
		Appendix I—Graduate Studies	213
		Index	218

1946 CALENDAR 1946

JANUARY

Sun.	..	6	13	20	27
Mon.	..	7	14	21	28
Tues.	1	8	15	22	29
Wed.	2	9	16	23	30
Thur.	3	10	17	24	31
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Sat.	5	12	19	26	....

FEBRUARY

Sun.	..	3	10	17	24
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Wed.	..	6	13	20	27
Thur.	..	7	14	21	28
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MARCH

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APRIL

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MAY

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JUNE

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JULY

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AUGUST

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SEPTEMBER

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OCTOBER

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NOVEMBER

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DECEMBER

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1947 CALENDAR 1947

JANUARY

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APRIL

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Fri.	5	12	19	26	....
Sat.	6	13	20	27	....

SECTION I. CALENDAR 1946-1947

FALL TERM 1946

July 15 Mon.....Last day for receiving applications for Supplemental Examinations.

Aug. 10 Sat.......Students of the III Year, Courses 1, 2, and 9, report at Survey Camp.

Sept. 2 Mon.....Labour Day. Buildings closed.

Sept. 3 Tues.....Last day for receiving applications for admission to the I Year.

Students of the II Year, Course 6, report at Ajax for Chemical Laboratory.

Sept. 9 Mon.....Supplemental Examinations commence.

Sept. 16-21 Mon.-Sat....Registration in person of the I Year from 9.30 a.m. to 12 noon and from 2.00 p.m. to 4.30 p.m. (Saturday 9.30 a.m. to 12.00 noon) at Ajax and Toronto.

Sept. 19 Thurs....Special meeting of Faculty Council.

Sept. 23 Mon.....Students in Architecture of the II, III, and IV Years report at the Survey Camp.

Sept. 23-24 Mon.-Tues..Registration in person of the II Year from 9.30 a.m. to 12.00 noon and 2.00 p.m. to 4.30 p.m. at Ajax.

Sept. 24 Tues.....Registration in person of the III and IV Years (except Architecture) and V Year Architecture from 9.30 a.m. to 11.30 a.m. and 1.45 p.m. to 4.30 p.m. at the Mining Building, Toronto.

Dean's address to the I Year at Ajax.

Preliminary instruction to the I Year at Ajax.

Meeting of Faculty Council.

Sept. 25 Wed.....Lectures and laboratory work commence at 9.00 a.m.

The opening address by the President to the Toronto students of all Faculties at 3.45 p.m. in Convocation Hall.

Oct. 1 Tues.....Meeting of Faculty Council.

Oct. 2 Wed.....Registration in person, at the Faculty Office, of II, III and IV Years in Architecture, from 9.30 a.m. to 12 noon.

Oct. 5 Sat.......Meeting of Caput.

Oct. 11 Fri.......Meeting of Senate.

Oct. 14 Mon.....Meeting of Engineering Society.

Nov. 1 Fri.......Meeting of Faculty Council.

Nov. 8 Fri.......Meeting of Senate.

Nov. 11 Mon.....Remembrance Day Service at the Soldiers' Tower at 11.00 a.m. Neither lectures nor laboratory classes given in Toronto from 10.00 a.m. to 1.00 p.m.
Nov. 12 Tues.....Meeting of Engineering Society.
Dec. 2 Mon.....Meeting of Faculty Council.
Dec. 5 Thur.....Meeting of Engineering Society.
Dec. 13 Fri.......Meeting of Senate.
Dec. 20 Fri.......Term ends at 5.00 p.m.

SPRING TERM 1947

Jan. 1 Wed.....Buildings closed.
Jan. 6 Mon.....Spring Term begins.
Mid-session examinations commence.
Jan. 10 Fri.......Meeting of Senate.
Jan. 13 Mon.....Meeting of Faculty Council.
Meeting of Engineering Society.
Jan. 15 Wed.....Last day for receiving the second term instalment of fees.
Feb. 3 Mon.....Meeting of Faculty Council.
Feb. 10 Mon.....Meeting of Engineering Society.
Feb. 14 Fri.......Meeting of Senate.
Feb. 25 Tues.....Meeting of Engineering Society (nominations).
Feb. 28 Fri.......Engineering Society Annual Elections.
Mar. 3 Mon.....Meeting of Faculty Council.
Mar. 12 Wed.....Engineering Society Annual General Meeting.
Mar. 14 Fri.......Meeting of Senate.
Apr. 1 Tues.....Meeting of Faculty Council.
Apr. 3 Thur.....Term ends at 5.00 p.m.
Apr. 4 Fri.......Good Friday.
Apr. 10 Thur.....Annual Examinations commence.
Apr. 11 Fri.......Meeting of Senate.
May 1 Thur.....Meeting of Faculty Council.
May 9 Fri.......Meeting of Senate.
June 2 Mon.....Meeting of Senate.
June 5-6 Thur-Fri...University Commencement.

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Warden of Hart House.................J. B. BICKERSTETH, M.C., M.A.
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Acting Assistant Director of University Health Service in Charge of Women MISS F. H. STEWART, B.A., M.D.
Manager of the University of Toronto Press...........A. G. BURNS, B.A.

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Assistant to Director of Studies, Ajax...........H. L. SHEPHERD, B.A.Sc.

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Director.....................................J. R. GILLEY, B.A.Sc.
Deputy Bursar........................G. L. COURT, D.F.C., B.Com.
Deputy Superintendent..........................J. SHORTREED, B.A.Sc.
University Health Service Staff Physician..W. F. MCKENZIE, M.C., M.D.
Junior Staff Physician..........................R. M. ROGERS, M.D.
Supervisor, Hart House, Ajax.......................D. L. EMOND, B.A.

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Demonstrator in Mechanical Engineering.
D. G. Darling, B.A.Sc. 343 Annette St.
Demonstrator in Mechanical Engineering.
J. A. Ketola, B.A.Sc. 177 Willow Ave.
Demonstrator in Mechanical Engineering.

DEPARTMENT OF METALLURGICAL ENGINEERING

L. M. Pidgeon, B.Sc. (Ox.), Ph.D. (McG.), F.R.S.C.
Professor of Metallurgical Engineering. 185 Rosedale Heights Dr.
J. A. Newcombe, B.Sc. (Lond.), A.R.S.M., F.R.I.C. 10 Bowmore Rd.
Professor of Metallurgical Engineering.
R. J. Montgomery, B.Sc., Cer.E. (Ohio) 2 Glenview Ave.
Associate Professor of Ceramics.
J. E. Toomer, B.Sc. (North Carolina) 707 Eglinton Ave. W.
Assistant Professor of Metallurgical Engineering.
J. K. Swinton, B.A.Sc. 223 Woodbine Ave.
Instructor in Metallurgical Engineering.

DEPARTMENT OF MINING ENGINEERING

C. G. Williams, B.A.Sc. 417 Rosemary Rd.
Professor of Mining Engineering.
J. T. King, B.A.Sc. 126 Manor Rd. E.
Professor of Assaying.
S. E. Wolfe, M.A.Sc. Streetsville
Assistant Professor of Mining Engineering.
S. G. Farrar, B.A.Sc. Lorne Park
Instructor in Mining Engineering.
L. Pancer, B.A.Sc. 154 Gorevale Ave.
Instructor in Mining Engineering.

W. J. NICHOLS, B.A.Sc. — 95 Normandy Blvd
Demonstrator in Mining Engineering.
T. R. MORTON, B.A.Sc. — 199 Cedarville Ave.
Demonstrator in Mining Engineering.

OTHER SPECIAL LECTURERS

R. R. GRANT, O.L.S., C.A. — 103 Blythwood Rd..
Special Lecturer in Accountancy and Business.
P. H. MILLS, B.A.Sc. — 80 King St. W.
Special Lecturer in Engineering Law.

PROFESSORS OF OTHER FACULTIES GIVING INSTRUCTION TO STUDENTS IN APPLIED SCIENCE

D. S. AINSLIE, M.A., PH.D. — 88 Chatsworth Dr.
Associate Professor of Physics.
MISS E. J. ALLIN, M.A., PH.D. — Apt. 35, 8 St. Thomas St.
Assistant Professor of Physics.
F. C. AULD, K.C., B.A. (McG.), M.A., B.C.L. (Ox.) — 3 Earl St.
Professor of Jurisprudence.
D. C. BAILLIE, M.A. — 79 Hilton Ave.
Assistant Professor of Mathematics.
C. BARNES, M.Sc. (Leeds), PH.D. — 269 St. Leonards Ave.
Associate Professor of Physics.
F. E. BEAMISH, M.A. (McM.) — 277 Heath St. E.
Associate Professor of Chemistry.
S. BEATTY, M.A., PH.D., F.R.S.C. — 537 Markham St.
Professor of Mathematics.
V. W. BLADEN, M.A. (Ox.), F.R.S.C. — 103 Woodlawn Ave. W.
Professor of Political Economy.
A. A. BRANT, M.A., PH.D. (Berlin) — 15 Grenadier Heights
Associate Professor of Geophysics.
R. BRAUER, PH.D. (Berlin), F.R.S.C. — 114 Balmoral Ave.
Associate Professor of Mathematics.
J. D. BURK, B.A. — 30 Duggan Ave.
Associate Professor of Mathematics.
J. T. BURT-GERRANS, PHM.B., M.A., PH.D. — 46 Dewson St.
Professor of Electrochemistry.
E. F. BURTON, O.B.E., B.A. (Tor.), (Camb.), PH.D., F.R.S.C.
Professor of Physics. — 224 Queen's Drive, Weston
M. F. CRAWFORD, B.A. (West.), M.A., PH.D., F.R.S.C.
Associate Professor of Physics. — 11 Washington Ave.
J. B. FERGUSON, B.A., F.R.S.C. — 100 Albertus Ave.
Associate Professor of Chemistry.

T. HEDMAN, PH.B. (Chic.) 171 Old Forest Hill Rd.
Associate Professor of German.
J. H. HODGSON, B.A. 37 St. Clements Ave.
Assistant Professor of Geophysics.
H. J. C. IRETON, M.A., PH.D. 76 Lonsdale Rd.
Professor of Physics.
N. B. KEEVIL, M.SC. (Sask.), PH.D. (Harv.) Lake Shore Rd.
Assistant Professor of Geophysics. Port Credit
MISS C. C. KRIEGER, M.A., PH.D. 382 Roxton Rd.
Assistant Professor of Mathematics.
G. B. LANGFORD, B.A.SC., PH.D. (Cor.), F.R.S.C. R.R. No. 1
Professor of Mining Geology Downsview
D. J. LE ROY, M.A., PH.D. 625 Oriole Parkway
Assistant Professor of Chemistry.
A. MACLEAN, B.A. 488 Spadina Ave.
Professor of Geology.
V. B. MEEN, M.A., PH.D., 34 Birchview Blvd.
Assistant Professor of Mineralogy.
E. S. MOORE, M.A., PH.D. (Chic.), F.R.S.C. 18 Indian Grove
Professor of Geology.
W. W. MOORHOUSE, M.A., PH.D. (COL.) 898 Islington Ave., Islington
Assistant Professor of Geology.
M. A. PEACOCK, M.A. (Harv.), PH.D., D.SC. (Glas.), F.R.S.C.
Professor of Crystallography and Mineralogy 81 Moore Ave.
I. R. POUNDER, M.A., PH.D. (Chic.) 19 Glen Gordon Rd.
Professor of Mathematics.
R. RICHMOND, M.A., PH.D. 41 Roslin Ave.
Assistant Professor of Physics.
D. A. F. ROBINSON, M.A., PH.D. (Chic.) 592 University Ave.
Associate Professor of Mathematics.
L. J. ROGERS, B.A.SC., M.A. 110 Garfield Ave.
Professor of Analytical Chemistry.
L. S. RUSSELL, B.SC. (Alta.), M.A., PH.D. (Princ.), F.R.S.C.
Assistant Professor of Palaeontology. 115 Macdonnel Ave.
J. SATTERLY, M.A. (Camb.), D.SC. (London), F.R.S.C. 95 Bernard Ave.
Professor of Physics.
A. F. C. STEVENSON, M.A., PH.D. (Camb.), F.R.S.C. 28 Summerhill Gdns.
Associate Professor of Applied Mathematics.
W. J. WEBBER, B.A. (Camb.) 18 Kappele Ave.
Associate Professor of Mathematics.
A. WEINSTEIN, PH.D. (Zurich), D.ÈS.SC. (Paris) 469 Spadina Rd.
Associate Professor of Applied Mathematics.
F. E. W. WETMORE, B.SC. (N.B.), M.A., PH.D. 53 Bayview Ave.
Assistant Professor of Chemistry.
A. M. WYNNE, M.A. (Qu.), PH.D., F.R.S.C. 27 Lytton Blvd.
Professor of Biochemistry.

SECTION IV. HISTORICAL SKETCH

The Legislative Assembly of the Province of Ontario during the Session of 1877 gave its sanction to the establishment of a School of Practical Science on the basis proposed in the memorandum of the Minister of Education confirmed by the Lieutenant-Governor in Council on the 3rd day of February, 1877.

By the scheme thus approved the Government effected an arrangement with the Council of University College whereby the instruction given by its professors and lecturers in all departments of science embraced in the work of the School was made available to students of the School. This arrangement was brought to an end in 1889 by the transfer of the departments of science, above referred to, from University College to the University of Toronto under the operation of the University Federation Act. In order that the students of the School might continue to enjoy the advantage of the instruction of the above departments, the Senate of the University of Toronto passed a statute in October, 1889, affiliating the School with the University. The statute was confirmed by the Lieutenant-Governor on the 30th day of October, 1889.

By an Order-in-Council, approved by the Lieutenant-Governor on the 6th day of November, 1889, a Principal was appointed, and the management of the School was entrusted to a council composed of the Principal as chairman, and the Professors, Lecturers, and Demonstrators appointed in the Teaching Faculty of the School.

On December 14th, 1900, the Senate, by statute subsequently approved by the Lieutenant-Governor in Council, established a Faculty of Applied Science and Engineering but without assuming any liability for its support or maintenance. Under this statute the teaching staff and examiners of the School of Practical Science became the teaching staff and examiners of the Faculty, although the University retained the right to appoint the examiners for the Bachelor of Applied Science and professional degrees. By the University Act of 1906 the School of Practical Science became the Faculty of Applied Science and Engineering of the University of Toronto.

On April 8th, 1892, the Senate of the University established the Degree of B.A.Sc., which was open to those who held the Diploma of the School and were prepared to devote a fourth year to advanced work. In the Session of 1909-1910 a new course extending over four years and leading to the Degree of B.A.Sc., came into operation, taking the place of the long established diploma course of three years, which came to an end in the Session 1910-1911. In the session 1923-24 the degree was changed to B. Arch. for the students graduating in Architecture.

SECTION V. ADMISSION AND REGISTRATION

Inquiries about admission to this Faculty should be sent to the Registrar of the University.

GENERAL

1. Candidates for admission in 1946 to the Faculty of Applied Science and Engineering must submit the certificates listed below as evidence that they are qualified to take one of the courses of instruction and proceed to a degree. Applicants must also submit a certificate of good character, and must have completed the seventeenth year of their age. The procedure for application and registration is described in paragraph 8 below.

2. In general, the holding of any of the following classes of certificate will constitute qualification for admission to this Faculty.

- (*a*) The Ontario Secondary School Graduation Diploma in either the General Course or the Vocational Course (Industrial Department), and the Ontario Grade XIII certificate as described in paragraph 3 below.
- (*b*) Certificates of having passed certain equivalent examinations as described in paragraph 5 below.
- (*c*) Certificates of undergraduate work in other universities. See admission to advanced standing, paragraphs 6 and 7 below.

The Senate will consider applications for the recognition of certificates other than those mentioned as occasion may require. Such certificates must be accompanied by an official statement of the marks in the various subjects upon which the certificate was granted.

3. SECONDARY SCHOOL GRADUATION DIPLOMA

No subjects are definitely prescribed, but the diploma must show credit for **four** optional subjects.

GRADE XIII

ENGLISH
MATHEMATICS (Algebra, Geometry, Trigonometry)
SCIENCE (Chemistry and Physics)
One of FRENCH
GERMAN
GREEK
ITALIAN
LATIN
SPANISH

It is highly desirable that applicants for admission should have a good standing in Mathematics (Algebra, Geometry, Trigonometry).

A candidate applying to enter the course in Engineering Physics must have met the regular requirements for admission to the faculty and, in

addition, have obtained an average of seventy-five per cent. in Mathematics (Algebra, Geometry, and Trigonometry) of the Grade XIII examination. A candidate whose general proficiency record in other subjects is not considered by the Council to be sufficiently high will not be admitted.

A candidate applying to enter the course in Aeronautical Engineering must have met the regular requirements for admission to the Faculty, and, in addition, must have good standing in Mathematics and Science. A candidate whose general proficiency record in other subjects is not considered by the Council to be sufficiently high will not be admitted to the course.

4. Those intending to enter the course in Architecture are recommended to select French as one of the admission subjects; those intending to enter Chemical, Civil, Electrical, Mechanical, Metallurgical Engineering, or Engineering Physics are recommended to select German.

EQUIVALENT CERTIFICATES

5. Certificates of the following examinations recognized as equivalent in value to the Ontario Secondary School Graduation Diploma and Grade XIII certificate may be accepted in so far as they meet the admission requirements of the University of Toronto and conform to the admission requirements of the universities of the respective provinces. A candidate applying for admission on such certificates must submit an official statement of the marks upon which these certificates were awarded.

PROVINCE OF ONTARIO

The Middle School Certificate now known as the Grade XII certificate or the Secondary School Graduation Diploma; the Upper School or Grade XIII certificate.

PROVINCE OF QUEBEC

Quebec High School Leaving and Senior High School Leaving certificates; the Junior and Senior Matriculation certificates of McGill University.

PROVINCE OF NEW BRUNSWICK

Junior and Senior Matriculation certificates.

PROVINCE OF NOVA SCOTIA

High School certificates of Grade XI and Grade XII issued by the Department of Education.

PROVINCE OF MANITOBA

The Junior (Grade XI) and Senior (Grade XII) Matriculation certificates.

PROVINCE OF BRITISH COLUMBIA

The University Entrance or Junior Matriculation certificate and the Senior Matriculation certificate.

PROVINCE OF PRINCE EDWARD ISLAND

First Class License certificates issued by the Education Department or Honour Diplomas issued by the Prince of Wales College; Third Year certificates issued by the above College.

PROVINCE OF ALBERTA

The Junior (Grade XI) and Senior (Grade XII) Matriculation certificates.

PROVINCE OF SASKATCHEWAN

The Junior (Grade XI) and Senior (Grade XII) Matriculation certificates.

NEWFOUNDLAND

Junior and Senior Associate diplomas of the Department of Education.

NEWFOUNDLAND AND THE MARITIME PROVINCES

Certificates of the Common Examining Board.

GREAT BRITAIN

Certificate of having passed, or having exemption from the Preliminary Examination of the Institution of Civil Engineers in the British Isles, or equivalent.

ADMISSION TO ADVANCED STANDING

6. An undergraduate of another university may be admitted to advanced standing on such conditions as the Senate, on the recommendation of the Council of the Faculty, may prescribe.

7. An applicant for admission to advanced standing must submit with his application for admission: (1) an official transcript of his record in the University from which he wishes to transfer, showing in detail the courses which he has completed, with his standing in each; (2) certificate of honourable dismissal; (3) calendar of the university giving a full description of these courses.

PROCEDURE FOR APPLICATION AND REGISTRATION

8. Candidates for admission should apply to the Registrar of the University for forms of applications for admission; they are required to fill in these forms in duplicate and return them to the Registrar *not later than* September 1st, together with the following: (*a*) the Ontario Secondary School Graduation Diploma in the General Course and the Ontario Grade XIII certificate; (*b*) any other evidence of ability to take the work proposed; (*c*) certificate of good character. Failure to make early application will result in delay and inconvenience for the candidate.

9. Every person admitted to the University as an undergraduate must, at the time of his or her first medical examination by the University Health Service, present satisfactory evidence of successful vaccination, or must be vaccinated by the examining physician.

10. Every student must register in person with the Secretary of the Faculty as prescribed on page 5 of the Calendar.

11. A student who fails to register as prescribed in clause 10, must petition the Council for permission to register late. The Council, however, reserves the right to refuse the permission, or to impose a penalty, such penalty to be reckoned at one dollar per day, or part thereof, that elapses between the close of registration as prescribed and the filing of the petition.

12. A petition for permission to register late must be accompanied by a deposit equal to the estimated amount of the penalty. Should the Council decide that no penalty is to be imposed, the deposit will be refunded.

SECTION VI. FEES, DEPOSITS AND EXPENSES

FEES

1. A student who desires to enrol in the Faculty of Applied Science and Engineering is required to pay at least the First Term Instalment of fees on or before the opening date of the session, and before he can receive his registration card from the Secretary of the Faculty. The amount of the First Term Instalment of fees or of the Total Fee for the session may be ascertained from the schedule of fees below.

2. The Second Term Instalment of fees, if not already paid, is payable on or before January 15th. After this date an additional fee of $1.00 a month will be imposed until the whole amount is paid. All fees for the session must have been paid in full before the student can be admitted to the annual examinations.

3. In order to avoid delay in registration at the opening of the session it is recommended that at least the First Term Instalment of fees be forwarded by mail as early as possible in September, together with a form, in duplicate, to be provided by the Secretary of the Faculty and filled out by the student, giving his full name, course, year, etc.

4. University fees are payable at the Office of the University Bursar, Simcoe Hall, which will be open for the receipt of fees from 9 a.m. to 5 p.m. daily from September 16th to 25th (Saturday, September 21st, 9 a.m. to 12.30 p.m.), and from 9 a.m. to 1 p.m. daily except Saturday during the remainder of the session. Cheques in payment of these fees should be made payable to the University of Toronto at par in Toronto.

5. All University Fees payable by students enrolling for courses at Ajax are payable at "The Bursar's Office, Ajax Division, University of Toronto, Ajax, Ontario". All remittances should be made at par at either Toronto or Ajax, payable to "UNIVERSITY OF TORONTO, AJAX DIVISION".

Fees forms and remittances should be mailed to the Bursar's Office, Ajax, as early as possible in order that the forms may be returned in sufficient time for registration.

Provision will be made in the Bursar's Office, Simcoe Hall, Toronto, for receiving payment of fees from students registering for courses at Ajax during the week of registration of the first year September 16th-21st, 1946.

6. Each undergraduate enrolled in the Faculty of Applied Science and Engineering must pay annual fees to the University Bursar according to the schedule below; the total fee in each case is made up of the academic fee and incidental fees; all incidental fees are payable in the first term.

SCHEDULE OF FEES

Academic Year	*Academic Fee	†Incidental Fees	Total Fee (if paid in one instalment)	First Term Instalment	Second Term Instalment
			Men		
First, Second, Third, Fourth, & Fifth.......	$250	$41	$291	$166	$128
			Women		
First.........	$250	$27	$277	$152	$128
Second, Third, Fourth & Fifth	250	24	274	$149	128

OTHER UNIVERSITY FEES

7. Each student is required to pay to the University Bursar at the opening of the session, or as otherwise specified, such of the following fees as may be required of him.

EQUIVALENT CERTIFICATE FEE

8. Each student who has been admitted to the First Year upon a certificate or certificates granted outside the Province of Ontario and covering all or any part of the admission requirements, must pay a fee of $5.00.

ADVANCED STANDING FEE

9. Each student who has been admitted to advanced standing from another university or college, must pay a fee of $10.00.

SUPPLEMENTAL PHYSICAL TRAINING FEE

10. Each student who has neglected to complete satisfactorily the course in Physical Training of the First or Second Year, and who must take this work during the Second or Third Years respectively of his or her attendance, must pay a fee of $10.00.

SUPPLEMENTAL EXAMINATION FEES

11. Each candidate for a supplemental examination is required to pay a fee to the Bursar not later than September 1st. The fee is $10.00 for either one or two supplemental examinations, including laboratory supplementals. For each supplemental examination in a laboratory subject requiring special supervision, there is an additional fee of $10.00. The additional laboratory supplemental fee should not be paid until the candidate is notified by the Secretary.

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*The Academic Fee includes the following fees:—
Tuition; Library, Laboratory Supply; and one Annual Examination.

†These Incidental Fees include the following fees:—
For men—Hart House; Students' Administrative Council; Athletic; Health Service; Physical Training; Engineering Society; Faculty Athletic Association; and Laboratory Deposit.
For women—Students' Administrative Council; Athletic; Health Service, Physical Training (for the First Year only); and Engineering Society; and Laboratory Deposit.

DEGREE FEE

12. Each candidate for the degree of Bachelor of Applied Science or Bachelor of Architecture must pay a fee of $10.00 to the Bursar on or before January 15th of his final year.

LABORATORY DEPOSIT

13. A laboratory breakage deposit of $10 is included in the incidental fees. This deposit, less charges for waste, neglect, and breakages will be refunded at the end of the session. Should the deposit be insufficient to meet the charges, a levy will be made to cover the deficiency.

SUMMARY OF STUDENTS' EXPENSES

14. The following approximate statement of expenses will give the student a general idea of the cost of obtaining an education in the Faculty of Applied Science and Engineering in the University of Toronto, exclusive of personal expenses:—

1. Fees, see schedule, page 26.
2. Board and Lodging, per week .... $ 8 to $10
3. Books and instruments, per year................ $35 to $45

SECTION VII. COURSES AND DEGREES

1. At the time of registration in the Faculty, the applicant is required to indicate the graduating course in which he intends to proceed to a degree. There are ten courses in Engineering, and the School of Architecture, from which the selection may be made, viz.,

Civil Engineering (Course 1),
Mining Engineering (Course 2),
Mechanical Engineering (Course 3),
Architecture (Course 4),
Engineering Physics (Course 5),
Chemical Engineering and Applied Chemistry (Course 6),
Electrical Engineering (Course 7),
Metallurgical Engineering (Course 8).
Ceramic Engineering (Course 8a).
Mining Geology (Course 9),
Aeronautical Engineering (Course 10).
Engineering and Business (Course 11).

2. The Degree of Bachelor of Applied Science will be awarded to students who complete one of the courses in Engineering, and Bachelor of Architecture to those who complete the course in Architecture.

3. The courses in Engineering extend over four academic years; the course in Architecture extends over five. A student must pass in the work of each academic year before proceeding to the work of the next. See Sec. X.

4. If, for any reason, an undergraduate wishes to change his course, he must petition the Faculty Council and obtain its approval. Such petition should be submitted by September 15, 1946.

5. Students must conform to all lecture room and laboratory regulations. Reports, briefs, theses, and drawings become the property of the Council to dispose of as it may see fit. Drawings, briefs, and field notes will not be accepted unless they have been made at the time and place provided in the time-table.

6. The curricula of the courses of instruction in Engineering and Architecture are given in Sec. IX.

7. Examinations are conducted as explained in Sec. X.

8. Students in Civil Engineering, Mining Engineering, Mechanical Engineering, Architecture, Electrical Engineering, and Mining Geology and Engineering and Business are required to have practical experience in offices, shops, or field, before their degree is granted. Students are asked to submit certificates of this experience as soon as possible after the completion of each period of work. (See Sec. IX.)

GRADUATE AND PROFESSIONAL DEGREES

1. Graduates in Engineering or Architecture may proceed to post-graduate and professional degrees. The post-graduate degrees are M. Arch., M.A.Sc., and Ph.D. The professional degrees are C.E., Chem. E., E.E., M.E. (Mechanical Engineer), M.E. (Mining Engineer), and Met. E.

2. Bursaries and scholarships for graduate students are available in limited number as shown on page 155. In times of peace, many part-time demonstratorships are open which permit post-graduate work towards a degree.

3. The courses for these degrees are under the direction of the School of Graduate Studies, and candidates should send their inquiries to the Secretary of the School of Graduate Studies. Page 213 of this Calendar contains further information on graduate studies in Applied Science and Engineering.

ASSOCIATIONS OF PROFESSIONAL ENGINEERS

Graduation from the Faculty of Applied Science and Engineering leads to registration as a Professional Engineer in the various Associations of Professional Engineers throughout Canada.

SECTION VIII. SCHOOL OF ENGINEERING RESEARCH

THE SCHOOL

A School of Engineering Research, within the Faculty of Applied Science and Engineering, was established in the Spring of 1917 at the suggestion of the late Dean Ellis.

The School is under the direct supervision of a Committee of Management composed of members of the Faculty Council. To this Committee of the Council is entrusted the selection of researches to be undertaken under the auspices of the School, and the disposition of funds for conducting them.

The School was organized chiefly for the training of graduates in methods of research and for the carrying out of investigations. These latter may be problems relating to specific industries of raw materials and having a specific end in view, or general problems having to do with fundamental principles.

RESEARCH ASSISTANTS

A number of research assistants in the School of Engineering Research are appointed annually on salary in the various departments of the Faculty to carry on the work of research under direction of members of the staff. This work is accepted as partial fulfilment of the requirements for the degrees of M.A.Sc., M.Arch., and Ph.D. These research assistants are usually recent graduates, and are chosen from among those who have displayed special capacity for investigation in their undergraduate courses. Applicants should consult with members of the staff as soon as possible after the April examinations.

The facilities of the School are also open to graduates who desire to penetrate more deeply into particular phases of experimental work, or to undertake investigations either suggested by members of the staff or arising from their own work since graduation.

INQUIRIES

All communications should be sent to the Secretary of the Committee of Management, Mr. W. S. Wilson.

SECTION IX. CURRICULUM

The courses of instruction are designed to give the student a thorough grounding in the fundamentals of engineering or architecture, and, in addition, sufficient familiarity with the practical application of the principles to make him useful upon graduation. The courses are very similar in the First Year with the exception of those of Architecture, Engineering Physics, and Aeronautical Engineering. In the succeeding years specialization develops to some extent with provision in the Third and Fourth years for optional subjects in some of the graduating courses.

In the teaching of fundamentals, instruction is not confined wholly to Applied Science. As the future engineer is vitally concerned with the development of the country, it is essential that he be instructed in the rudiments of economics, administration, and business, which, with his scientific training, will enable him to increase his usefulness to the full.

In some graduating courses, laboratory work in the Fourth Year consists of the investigation of some specific problem. In all instances the student's knowledge of the original literature and primary sources of information is extended, and he is given a very desirable and useful training in methods of research. In this way the undergraduate course is linked with the graduate courses (page 213), and with the work of the School of Engineering Research (page 30).

As part of the laboratory instruction, excursions to places of technical interest, both in Toronto and elsewhere, are arranged by the staff. These excursions are treated as laboratory periods with the same requirements as to attendance and reports. The total transportation costs in any one year will probably not exceed ten dollars.

On the following pages of this section, the curriculum for each course is set forth in detail. The time devoted to lectures and practical work is indicated as accurately as possible, but is subject to modification as occasion may require. The program and regulations regarding the courses of study and examination, contained in this Calendar, hold good for this academic year only, and the Faculty of Applied Science and Engineering does not bind itself to adhere for the whole period of a student's course to the conditions here laid down.

Communications relating to curricula, instruction, and examinations in the Faculty of Applied Science and Engineering should be sent to the Secretary of the Faculty.

For information regarding the courses of study leading to the post-graduate degrees, Master of Applied Science, Master of Architecture, and Doctor of Philosophy, see pages 213 and 214 of this calendar, and the calendar of the School of Graduate Studies, which gives full particulars.

CIVIL ENGINEERING

(COURSE 1)

The normal course in Civil Engineering has been so designed as to be broad and comprehensive, with a view to meeting not only the needs of those who have definitely decided to enter this branch of the profession, but also of those who desire a technical training of such a basic character as to enable them to enter various other fields of technical employment. Concurrent with the instruction in engineering subjects, sufficient attention is given to economic, legal, and administrative matters to make the graduate in this course fitted to enter not only upon such work as Municipal Engineering, Sanitary Engineering, Highway Engineering, Railway Engineering, Geodetic Surveying, Structural Engineering, and Hydraulic Engineering, but also upon administrative and executive work in both engineering and industrial undertakings.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Analytical Geometry, 492, page 133.

PRACTICAL EXPERIENCE

Before receiving the degree, every student in Civil Engineering is required to submit satisfactory evidence of having had at least 600 hours of practical experience. (See subject 690).

GRADUATE STUDY

Graduates of this University, or of other universities of comparable standing, who have taken the above mentioned or similar course with sufficiently high records may proceed with work leading to a graduate degree.

The time devoted to graduate study is divided between work on the subjects of mathematics, physics, fundamentals of civil engineering and related work on the approved civil engineering field of investigation chosen by the candidate.

Further information appears on page 213. The Calendar of the School of Graduate Studies should be consulted for details.

FIRST YEAR SUBJECTS COURSE 1	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry	492 275	1	1	2	1
Calculus	490, 275	2	2	2	2
Chemistry	221, 222	2	–	2	6
Descriptive Geometry	270	1	–	1	–
Dynamics	21, 275	1	1	2	1
Electricity	330	2	–	2	–
Engineering and Society	322	1	–	1	–
Engineering Problems and Drawing	275	–	9	–	4
English	610	1	–	1	–
Physical Training	640	–	2	–	2
Practical Experience	690	–	–	–	–
Statics	20, 275	1	1	2	1
Surveying	710, 712	1	3	–	–

SECOND YEAR SUBJECTS COURSE 1	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Alternating Currents	331, 350	1	–	1	3
Applied Physics	75, 76	1	3	1	3
Calculus	491	2	–	2	–
Descriptive Geometry	272	1	–	1	–
Dynamics	22	1	–	1	–
Economics	311	2	–	2	–
Engineering Chemistry	233	1	–	1	–
Engineering Problems and Drawing	284	–	8	–	8
Hydraulics, Elementary	447	1	–	–	–
Least Squares	494	–	–	1	–
Mechanics of Materials	23, 31	2	–	2	3
Physical Training	640	–	2	–	2
Practical Astronomy	200	–	–	2	–
Practical Experience	690	–	–	–	–
Spherical Trigonometry	493	1	–	–	–
Surveying	714, 716	1	8	1	–

Third Year Subjects Course 1	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Applied Elasticity	33	1	–	1	–
Astronomy and Geodesy	201	–	–	2	–
Business	310	–	–	1	–
Cements and Concrete	35, 44	1	2	1	–
Construction Surveying	717	1	–	1	–
Descriptive Geometry	274	1	–	–	–
Differential Equations	507	1	1	1	1
Elementary Structural Engineering	28	2	–	2	–
Engineering Problems and Drawing	291	–	10	–	9
Engineering Geology	385, 386	1	–	2	2
Heat Engines, Theory	427, 428	1	–	1	2
Hydraulics	440, 441	2	–	2	3
Machinery	463, 464	2	3	–	–
Modern World History	324	1	–	1	–
Petrography	582	1	1	–	–
Photographic Surveying	81	1	–	–	–
Physical Metallurgy	546	–	–	1	–
Political Science	323	1	–	1	–
Practical Experience	690	–	–	–	–
Survey Camp	720	–	–	–	–

Before entering the Fourth Year, all students must select which one of the five elective subjects they propose to study. Information regarding these subjects will be given at the end of the Third Year. Although required to take an examination in only one of the five subjects, students are encouraged to attend lectures in the subjects other than the ones they select, when this is possible.

FOURTH YEAR SUBJECTS COURSE 1	Subject No.	Hours per week First Term Lect.	First Term Lab.	Second Term Lect.	Second Term Lab.
Contracts and Specifications..	315	–	–	1	–
Engineering Economics......	313	–	–	1	–
Engineering Law............	314	1	–	–	–
Foundations................	39, 298	1	–	1	2
Hydraulics.................	445, 446	1	3	1	–
Management.................	316	1	–	1	–
Mechanics of Materials Lab...	38, 50	–	3	–	6
Modern Political and Economic Trends........	325	1	–	1	–
Philosophy of Science........	326	1	–	½	–
Practical Experience.........	690	–	–	–	–
Profession of Engineering.....	327	–	–	½	–
Soil Mechanics..............	40	1	–	–	–
Reinforced Concrete.........	41, 298	1	6	1	6
Structural Design...........	43, 298	2		1	
Theory of Structures........	36, 298	1		1	
Thesis.....................	730	–	3	–	3
And *one* of the following Elective Subjects:					
1a. Advanced Structural Engineering..........	34, 37,	2	5	2	4
1b. Advanced and Photographic Surveying.....	82, 83, 718, 719	2	5	2	4
1c. Municipal Engineering....	215, 301, 306	2	5	2	4
1d. Transportation Engineering...........	216	2	5	2	4
1e. Water Power Engineering.	217, 444	2	5	2	4

MINING ENGINEERING

(Course 2)

The course in Mining Engineering, which originated in 1878 as a course in Assaying and Mining Geology, is intended to serve as a preliminary training for those who expect to practise in some branch of Mining Engineering, such as exploration of mining areas and primary development; mine surveying; mining processes involving civil, mechanical and electrical work; underground operations; mining machinery and operation; milling and treatment of ores; assaying and other forms of analysis and research; and administrative work in both engineering and industrial undertakings.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Analytical Geometry, 492, page 133.

PRACTICAL EXPERIENCE

Before receiving the degree, every student in Mining Engineering is required to present satisfactory evidence of having had at least six months' practical experience. (See subject 691.)

GRADUATE STUDY

Graduates of this University, or of another university of comparable standing, who have taken the above course with a sufficiently good standing may proceed with work leading to a graduate degree.

The major portion of the student's time will be devoted to research work on some subject approved by the Department, but certain specified courses of instruction must also be taken, in which examinations are demanded.

Further information appears on page 213 of this Calendar. The Calendar of the School of Graduate Studies should be consulted for details.

FIRST YEAR SUBJECTS COURSE 2	Subject No.	Hours per week First Term Lect.	First Term Lab.	Second Term Lect.	Second Term Lab.
Analytical Geometry	492	1	–	2	–
Calculus	490	2	–	2	–
Chemistry	221, 222	2	6	2	6
Descriptive Geometry	270	1	–	1	–
Dynamics	21	1	–	2	–
Electricity	330	2	–	2	–
Engineering and Society	322	1	–	1	–
Engineering Problems and Drawing	276	–	6	–	6
English	610	1	–	1	–
Mechanical and Thermal Measurements	448	–	–	2	–
Mineralogy, Elementary	580, 583	–	–	2	1
Mining Laboratory	165	–	2	–	–
Physical Training	640	–	2	–	2
Practical Experience	691	–	–	–	–
Statics	20	1	–	2	–
Surveying	710, 712	1	3	–	–

SECOND YEAR SUBJECTS COURSE 2	Subject No.	Hours per week First Term Lect.	First Term Lab.	Second Term Lect.	Second Term Lab.
Alternating Currents	331, 350	1	–	1	3
Analytical Chemistry Laboratory	227	–	–	–	3
Blowpipe Analysis	589	–	–	–	2
Chemistry	224	1	–	1	–
Descriptive Geometry	272	1	–	1	–
Economics	311	2	–	2	–
Engineering Problems and Drawing	285	–	8	–	8
General Geology	388, 389	2	–	1	2
Heat Engines, Elementary	420	1	–	–	–
Mechanics of Materials	23, 31	2	–	2	3

SECOND YEAR SUBJECTS COURSE 2—*Continued*	Subject No.	Hours per week First Term Lect.	First Term Lab.	Second Term Lect.	Second Term Lab.
Mining	167	1	–	–	–
Optical Mineralogy, Elementary	597	–	–	1	–
Petrography	587	1	–	–	1
Physical Training	640	–	2	–	2
Practical Experience	691	–	–	–	–
Problems and Seminar	186	–	2	–	–
Surveying	715, 716	1	6	1	–
Theory of Measurements	182	1	–	–	–

THIRD YEAR SUBJECTS COURSE 2	Subject No.	Hours per week First Term Lect.	First Term Lab.	Second Term Lect.	Second Term Lab.
Analytical Chemistry	225, 237	1	3	1	3
Assaying	160, 161	1	3	–	3
Business	310	–	–	1	–
Economic Geology	399	1	–	2	–
Electrical Machinery	348	2	–	–	–
Elementary Structural Engineering	29	1	–	1	–
Engineering Problems and Drawing	292	–	3	–	3
Geological Field Work	380	–	–	–	–
Hydraulics	440, 441	2	1½	–	–
Introductory Research	183	–	–	–	3
Metallurgy	530	1	–	–	–
Mining	170	1	–	1	–
Modern World History	324	1	–	1	–
Ore Dressing	175, 176	–	–	2	6
Petrography, General	595, 596	–	–	1	2
Physical Metallurgy	546, 549	–	–	1	1
Political Science	323	1	–	1	–
Practical Experience	691	–	–	–	–
Principles of Ore Dressing	181	2	–	–	–
Problems and Seminar	186	–	2	–	–
Structural Geology	390, 391	2	3	–	–
Summer Letters	184	–	–	–	–
Survey Camp	720	–	–	–	–

FOURTH YEAR SUBJECTS COURSE 2	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Assaying	162, 163	–	–	1	3
Engineering Economics	313	–	–	1	–
Geology, Precambrian	392	2	–	–	–
Geology, Mining	396	–	–	2	–
Geology, Pleistocene and Physiographic	381, 382	1	1	1	–
Heat Engines, Theory	427, 428	1	1½	1	–
Hydraulics	451	–	–	1	–
Machine Design	469, 470	1	–	1	3
Metallurgy	538, 539	1	–	1	3
Mine Management	172	2	–	–	–
Mine Ventilation	173, 174	2	3	–	–
Mining	166, 171	–	–	2	3
Modern Political and Economic Trends	325	1	–	1	–
Ore Dressing	177, 178	1	6	1	–
Practical Experience	691	–	–	–	–
Profession of Engineering	327	–	–	½	–
Problems and Seminar	186	–	2	–	–
Philosophy of Science	326	1	–	½	–
Summer Essays	185	–	–	2	–
Thesis	731	–	6½	–	5

MECHANICAL ENGINEERING

(COURSE 3)

The mechanical engineer is concerned with the production and the use of power; and it is part of his work to design and manufacture suitable machinery for this purpose, and to install and operate it. The internal combustion engine and the steam turbine are the products of his effort, and he applies these prime movers to automobiles, aeroplanes, locomotives, and other purposes. His work also includes the design of water turbines and their use in hydro-electric systems.

Other branches of his work are the making of designs for air compressors, machine tools, pumps, refrigerating machines and their application to storage warehouses and ice-making, heating and ventilating equipment, materials-handling and conveying plants, and generally all mechanical work. General industrial and administrative problems are considered.

The course of study has been devised to equip men for work in the general field of mechanical and industrial engineering.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Analytical Geometry, 492, page 133.

SHOP WORK

Before receiving the degree, every student in Mechanical Engineering is required to spend 1200 hours in mechanical shops, either prior to entering or during the vacations. (See subject 692.)

GRADUATE STUDY

Graduates of this University, or of another university of comparable standing, who have taken the above course, or one similar, with a sufficiently good standing may proceed with work leading to a graduate degree.

Some part of the instructional period will be devoted to advanced work in Mathematics and the Fundamentals of Engineering. The remainder of the time will be given to a study of some specific branch of Mechanical Engineering work or to some definite Mechanical problem.

Further information appears on page 213. The Calendar of the School of Graduate Studies should be consulted for details.

FIRST YEAR SUBJECTS COURSE 3	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry	492, 277	1	1	2	1
Calculus	490, 277	2	2	2	2
Chemistry	221, 222	2	6	2	–
Descriptive Geometry	270	1	–	1	–
Dynamics	21, 277	1	1	2	1
Electricity	330	2	–	2	–
Engineering and Society	322	1	–	1	–
Engineering Problems and Drawing	277	–	3	–	10
English	610	1	–	1	–
Mechanical and Thermal Measurements	448	–	–	2	–
Physical Training	640	–	2	–	2
Practical Experience	692	–	–	–	–
Statics	20	1	1	2	1
Surveying	710, 712	1	3	–	–

SECOND YEAR SUBJECTS COURSE 3	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Calculus	491	2	–	2	–
Descriptive Geometry	272	1	–	1	–
Direct Current Machines	338	–	–	2	3
Dynamics	22	1	–	1	–
Economics	311	2	–	2	–
Electricity	332, 334	2	3	–	–
Engineering Chemistry	226	1	–	1	–
Engineering Problems and Drawing	286	–	8	–	12
Heat Engines, Elementary	420	–	–	2	–
Hydraulics, Elementary	447	1	–	–	–
Mechanical Engineering	461	–	–	2	–
Mechanics of Materials	23, 31	2	3	2	–
Physical Training	640	–	2	–	2
Practical Experience	692	–	–	–	–
Theory of Machines A	465	2	–	2	–
Treatment of Technical Data	449	2	–	–	–

THIRD YEAR SUBJECTS COURSE 3	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Alternating Current Machinery	345	–	–	2	–
Alternating Currents	340	2	–	–	–
Business	310	–	–	1	–
Electrical Laboratory	346	–	3	–	3
Elementary Structural Engineering	29, 293	1	3	1	3
Heat Engineering	422	2	–	2	–
Heat Engines, Theory	421, 423	2	3	2	3
Hydraulics	440, 441	2	–	2	3
Machine Design	467, 468	2	9	2	6
Modern World History	324	1	–	1	–
Physical Metallurgy	533	–	–	2	–
Political Science	323	1	–	1	–
Practical Experience	692	–	–	–	–
Theory of Machines B	466	2	–	–	–

FOURTH YEAR SUBJECTS COURSE 3	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Engineering Economics	313	–	–	1	–
Engineering Law	314	1	–	–	–
Heat Engine Laboratory	426	–	5	–	6
Heat Power Engineering	424	2	–	1	–
Heat Treatment of Iron and Steel	547, 548	1	–	1	1½
Hydraulics	442, 443, 444	2	5	3	6
Industrial Management	318	1	–	1	–
Internal Combustion and Air-Craft Engines	425	1	–	1	–
Machine Design	473, 474	2	5	2	6
Modern Political and Economic Trends	325	1	–	1	–
Philosophy of Science	326	1	–	½	–
Practical Experience	692	–	–	–	–
Profession of Engineering	327	–	–	½	–
Structural Engineering	46, 299	2	3	–	–
Thesis	732	–	1	–	1

SCHOOL OF ARCHITECTURE

(COURSE 4)

The School of Architecture was established as a Department of the School of Practical Science, later the Faculty of Applied Science and Engineering, in 1890, and is one of the oldest schools in the British Empire. The School is fortunate in enjoying a close connection with the Ontario Association of Architects and the Royal Architectural Institute of Canada, both of which organizations offer medals and scholarships for competition in the School.

The School is one of a limited number in the Empire recognized by the Royal Institute of British Architects, which admits graduates to Associate Membership on application, without examination. The Ontario Association of Architects, through its Registration Board, accepts the degree in Architecture, coupled with a twelve months period of office experience with an architect, as qualification to practise the profession of Architecture in the Province of Ontario. As a matter of fact, few graduates commence practice without a continuation of their practical training, and a year or two years' travel or additional experience in the employ of an architect is recommended.

It becomes increasingly clear that in the modern movement in Architecture, the architect must more and more be the "master builder" or the "architect" in the original meaning of that term. His interests are no longer confined to plans, elevations and specifications though those remain an important part of his job. With this new viewpoint in mind, structural subjects such as reinforced concrete and steel construction are given greater space and importance in all years. Positions in which architects find themselves in war work and will find themselves in post-war period, require such a knowledge to a greater extent, and students are being trained for such employment.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects, referring to a more detailed description, *e.g.*, History of Architecture, 110, page 89.

PRACTICAL EXPERIENCE

Before receiving the degree, every student in the School of Architecture is required to submit satisfactory evidence of having had 12 months' (1900 hours) practical experience. (See subject 693.)

FIRST YEAR SUBJECTS COURSE 4	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Studio	Lect.	Studio
Analytical Geometry........	492	1	–	2	–
Calculus....................	490	2	–	2	–
Architectural Drawing.......	121	–	14	–	15
Building Construction.......	140	–	–	1	–
Descriptive Geometry.......	270	1	–	1	–
Elements of Arch. Form......	118	1	–	1	–
Engineering and Society......	322	1	–	1	–
Engineering Problems and Drawing................	278	–	3	–	3
English....................	610	1	–	1	1
Freehand Drawing..........	131	–	2	–	2
History of Architecture......	110	1	–	1	–
Physical Training...........	640	–	2	–	2
Practical Experience.........	693	–	–	–	–
Statics.....................	20	1	–	2	–
Surveying..................	711	1	3	–	–

SECOND YEAR SUBJECTS COURSE 4	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Studio	Lect.	Studio
Architectural Design.........	122	–	15	–	21
Colour.....................	136	1	–	–	–
Descriptive Geometry.......	272	1	–	1	–
Economics..................	311	2	–	2	–
Freehand Drawing..........	132	–	2	–	2
History of Architecture......	111	1	–	1	–
Mechanics of Materials......	23	2	–	2	–
Modelling..................	137	–	2	–	2
Photography...............	77, 78	1	3	–	–
Physical Training...........	640	–	2	–	2
Practical Experience.........	693	–	–	–	–
Theory of Arch. Planning....	128	1	–	1	–

THIRD YEAR SUBJECTS COURSE 4	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Studio	Lect.	Studio
Architectural Design........	123	–	15	–	18
Commercial Law............	312	1	–	1	–
Freehand Drawing..........	133	–	2	–	2
Functional Requirements of Buildings...............	115	1	–	1	–
Garden Design.............	116	½	–	–	–
History of Architecture A....	112	1	–	½	–
History of Architecture B....	113	–	–	1	–
History of Sculpture.........	120	1	–	–	–
Light and Acoustics.........	85, 86	1	2	1	2
Measured Drawings.........	147	–	–	–	–
Modelling..................	138	–	2	–	2
Modern World History.......	324	1	–	1	–
Political Science............	323	1	–	1	–
Practical Experience.........	693	–	–	–	–
Public Speaking............	320	1	–	1	–
Structural Design...........	30	2	3	2	3

FOURTH YEAR SUBJECTS COURSE 4	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Studio	Lect.	Studio
Architectural Design........	124	–	17	–	17
Building Materials					
Stones..................	405	1	–	–	–
Ceramic.................	569	1	–	1	–
Architectural Application..	141	–	–	1	–
Contracts and Specifications..	315	–	–	1	–
Foundations................	39	1	–	1	–
Freehand Drawing..........	134	–	2	–	2
History of Painting.........	119	1	–	1	–
Housing...................	130	1	–	–	–
Illumination Design.........	87, 88	1	1	1	1
Modelling..................	139	–	2	–	2
Modern Political and Economic Trends........	325	1	–	1	–
Practical Experience.........	693	–	–	–	–
Outdoor Sketches...........	148	–	–	–	–
Sanitary Science............	142	1	–	1	–
Structural Design...........	42	1	3	1	3

FIFTH YEAR SUBJECTS COURSE 4	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Studio	Lect.	Studio
Architectural Design........	125	–	23	–	25
Architectural Economics.....	145	1	–	1	–
Heating and Air Conditioning	144	1	–	1	–
Philosophy of Science........	326	1	–	½	–
Practical Experience.........	693	–	–	–	–
Professional Practice........	143	1	–	1	–
Structural Design...........	47	1	3	1	3
Town Planning.............	117	–	–	1	–

ENGINEERING PHYSICS

(Course 5)

Admission to and promotion in this course is granted only to students who meet the special requirements set forth on pages 21 and 153 of this Calendar.

The course is designed to afford a training in Mathematics and Physics beyond that which it is possible to give in the other undergraduate courses in engineering. It is believed that a wider and more thorough acquaintance with the basic sciences will bring to the student a readier appreciation of the nature of the technical problems with which he will later be confronted and a greater facility in the solution of them. A course of the kind offered should consequently be of particular value to those who desire to enter governmental or industrial research laboratories, or who wish to engage in any original work of investigation or development in the field of applied physics.

Throughout the four years of the course an effort is made to maintain the practical point of view in the theoretical instruction. This is effected, in part, by adopting wherever possible the engineering viewpoint in the teaching of mathematical and scientific subjects, and, in part, by the inclusion of certain basic engineering instruction.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Algebra and Calculus, 502, page 133.

First Year Subjects Course 5	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Algebra and Calculus........	502	$3\frac{1}{2}$	–	$3\frac{1}{2}$	–
Analytical Geometry........	503	$1\frac{1}{2}$	–	$1\frac{1}{2}$	–
Applied Mechanics..........	24	2	–	2	–
Chemistry..................	221, 222	2	3	2	3
Descriptive Geometry.......	270	1	–	1	–
Electricity.................	330	2	–	2	–
Engineering and Society......	322	1	–	1	–
Engineering Problems and Drawing................	279	–	3	–	6
English....................	610	1	–	1	–
Physical Training...........	640	–	2	–	2
Properties of Matter, Mechanics and Heat......	650, 651	4	3	4	3
Surveying..................	710, 712	1	3	–	–

SECOND YEAR SUBJECTS COURSE 5	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Acoustics	654	1	–	–	–
Analytical Geometry of Space	506	1	–	1	–
Descriptive Geometry	272	1	–	1	–
Differential Calculus	504	3	–	3	–
Dynamics	22	1	–	1	–
Economics	311	2	–	2	–
Electricity	332, 334	2	3	–	–
Elementary Light	653	1	–	1	–
Elementary Magnetism and Electricity	652	1	–	2	–
Integral Calculus and Differential Equations	505	3	–	3	–
Machine Design	471, 472	1	3	1	3
Mechanics of Materials	23, 31	2	–	2	3
Organic Chemistry	250	1	–	1	–
Physics Laboratory	655	–	3	–	6
Physical Training	640	–	2	–	2

Students in Engineering Physics are required to state at the beginning of the Third Year the options they desire to pursue in the Third and Fourth Years. Permission to enter upon an option must be sought from the Council. This may be withheld if the number of students offering, or conditions existing at the time, render it impracticable to give the work.

THIRD YEAR SUBJECTS COURSE 5	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Differential Equations	509	1	1	1	1
Direct Current Machines	339	2	–	–	–
Heat	658	1	–	1	–
Mathematical Operations Applied to Physics	656	1	–	1	–
Modern World History	324	1	–	1	–
Physical Laboratory	659	–	3	–	3
Physical Metallurgy	533	–	–	2	–
Political Science	323	1	–	1	–
Properties of Matter	657	2	–	2	–
Theoretical Mechanics	520	1	1	1	1
Theory of Functions	508	1	1	1	1

And *one* of the following options which must be continued in the Fourth Year.

Option 5c, Electricity and Communications					
Option 5s, X-Rays and Spectroscopy					
Option 5i, Illumination and Acoustics					
Alternating Currents	341	2	–	2	–
Electrical Design	342	2	–	–	–
Electrical Laboratory	344	–	6	–	6
Geometrical Optics	660,661	1	3	–	–
Photometry	79,80	–	–	1	3
Electronics	337	–	–	3	–
Option 5g, Geophysics					
Alternating Currents	341	2	–	2	–
Electrical Laboratory	344	–	6	–	6
Engineering Geology	385,386	1	–	2	2
Mineralogy, Elementary	598,599	2	1	–	–
Optical Mineralogy, Elementary	597	–	–	1	–
Petrography, Elementary	587	1	–	–	1

THIRD YEAR SUBJECTS COURSE 5	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Option 5r, Refrigeration					
Alternating Current..........	340	2	–	–	–
Electrical Laboratory.........	347	–	3	–	3
Elementary Structural Engineering..............	29, 296	1	–	1	3
Properties of Living Matter...	210	2	–	2	–
Theory of Heat Engines......	421, 423	2	3	2	3

FOURTH YEAR SUBJECTS COURSE 5	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Option 5c, Electricity and Communications					
Acoustics	97	1	–	–	–
Acoustics, Advanced	664	1	–	–	–
Alternating Current Circuit Analysis	351	2	–	2	–
Communication	361, 362	2	3	2	3
Differential Equations of Mathematical Physics	521	2	–	2	–
Electrical Laboratory	356	–	6	–	6
Electrical Transmission of Energy	352	2	–	–	–
Electromagnetic Theory, Applied	365	2	–	2	–
Introduction to Atomic and Molecular Physics	663	1	–	1	–
Modern Political and Economic Trends	325	1	–	1	–
Operational Methods	364	2	–	2	–
Philosophy of Science	326	1	–	$\frac{1}{2}$	–
Physical Laboratory	665	–	3	–	3
Profession of Engineering	327	–	–	$\frac{1}{2}$	–
Thesis	733	–	–	–	–
Option 5s, X-Rays and Spectroscopy					
Acoustics	97	1	–	–	–
Acoustics, Advanced	664	1	–	–	–
Analysis of Materials by Spectrographic and X-ray Methods	669	1	–	1	–
Communication	361, 362	2	3	–	–
Differential Equations of Mathematical Physics	521	2	–	2	–
Electromagnetic Theory, Applied	365	2	–	2	–
Elementary Quantum Theory	668	1	–	–	–
Introduction to Atomic and Molecular Physics	663	1	–	1	–
Modern Political and Economic Trends	325	1	–	1	–
Morphological Crystallography	594	1	–	1	–

FOURTH YEAR SUBJECTS COURSE 5	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Option 5s, X-Rays and Spectroscopy (continued)					
Operational Methods	364	2	–	2	–
Optics, Advanced	666	1	–	1	–
Philosophy of Science	326	1	–	½	–
Physical Laboratory	665	–	9	–	12
Profession of Engineering	327	–	–	½	–
Series Spectra	667	–	–	1	–
Thesis	733	–	–	–	–
Option 5g, Geophysics					
Differential Equations of Mathematical Physics	521	2	–	2	–
Economic Geology	398, 400	1	3	3	3
Electromagnetic Theory, Applied	365	2	–	2	–
Geophysics	670, 671	2	9	2	9
Location of Mineral Deposits	401	–	–	1	–
Modern Political and Economic Trends	325	1	–	1	–
Petrography, General	590, 591	1	2	1	2
Philosophy of Science	326	1	–	½	–
Physics of the Earth	672	2	–	2	–
Profession of Engineering	327	–	–	½	–
Structural Geology	390, 391	2	3	–	3
Thesis	733	–	–	–	–

FOURTH YEAR SUBJECTS COURSE 5	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Option 5i, Illumination and Acoustics					
Acoustics, Advanced	664	1	–	–	–
Architectural Acoustics	89,90	1	3	3	9
Communication	361, 362	2	3	–	–
Differential Equations of Mathematical Physics	521	2	–	2	–
Modern Political and Economic Trends	325	1	–	1	–
Operational Methods	364	2	–	2	–
Philosophy of Science	326	1	–	$\frac{1}{2}$	–
Photometry and Illumination Design	95, 96	2	6	2	6
Physical Laboratory	674	–	3	–	3
Physics of Light Production	673	2	–	–	–
Profession of Engineering	327	–	–	$\frac{1}{2}$	–
Option 5r, Refrigeration					
Alternating Current Machinery	353, 367	2	3	2	–
Differential Equations of Mathematical Physics	521	2	–	2	–
Electronics	337, 368	–	–	3	3
Heat Power Engineering	424, 426	2	5	1	6
Heat Transfer and Refrigeration	429	2	–	2	–
Internal Combustion Engines	425	1	–	1	–
Low Temperature Physiology	211, 212	1	3	1	3
Modern Political and Economic Trends	325	1	–	1	–
Philosophy of Science	326	1	–	$\frac{1}{2}$	–
Physics of Light Production	673	2	–	–	–
Profession of Engineering	327	–	–	$\frac{1}{2}$	–
Thesis	733	–	–	–	–
Vibration Engineering	99, 100	1	3	1	3

CHEMICAL ENGINEERING AND APPLIED CHEMISTRY

(Course 6)

The course is designed to give the student a thorough training in the underlying principles and laboratory methods of inorganic, organic, physical, and analytical chemistry, in the applications of these to industrial chemistry and chemical engineering, and a general knowledge of the elements of thermodynamics, hydraulics, machine design, structural design, electricity, and metallurgy. A preliminary training of this nature with subsequent practical experience will enable him to undertake the design and construction, also the operation and management of the plant required in such branches of chemical industry as are concerned with the production of chemical and pharmaceutical products, petroleum and its products, rubber goods, leather and glue, soap, meat products, foodstuffs, vegetable and animal oils, sugar, pulp and paper, vegetable and animal fibres, artificial silk, plastics, coal tar and wood distillates, paints and varnishes, explosives, dyes, portland cement, metals and their alloys, electrochemical products, fermentation products, fertilizers, synthetic chemical products, etc.

For those who by temperament and ability are attracted to chemical research there exist excellent opportunities in government, industrial, and medical research laboratories. Properly qualified students wishing to pursue experimental investigation as a life-work, whether in industrial chemistry or in purely scientific chemistry, may proceed in this department to the degrees M.A.Sc. and Ph.D., the laboratory research work of the Fourth Year serving as a connecting link between the undergraduate and graduate courses.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Analytical Geometry, 492, page 133.

GRADUATE STUDY

Graduates of this University, or of another university of comparable standing, who have taken the above course, or one similar, with a sufficiently good standing may proceed with work leading to a graduate degree.

Students wishing to pursue further studies, whether in chemical engineering, industrial chemistry, or in pure scientific chemistry, may proceed in the Department of Chemical Engineering to the degrees M.A.Sc. and Ph.D.

The major portion of the student's time will be devoted to research work assigned by the Department, but certain specified courses of instruction must be taken in which examinations are demanded.

Further information appears on page 213 of this Calendar. The Calendar of the School of Graduate Studies should be consulted for details.

FIRST YEAR SUBJECTS COURSE 6	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry	492	1	–	2	–
Calculus	490	2	–	2	–
Chemistry	221, 222	2	9	2	6
Descriptive Geometry	270	1	–	1	–
Dynamics	21	1	–	2	–
Electricity	330	2	–	2	–
Engineering and Society	322	1	–	1	–
Engineering Problems and Drawing	280	–	2	–	6
English	610	1	–	1	–
Mechanical and Thermal Measurements	448	–	–	2	–
Mineralogy, Introductory	581	–	–	1	1
Physical Training	640	–	2	–	2
Statics	20	1	–	2	–
Surveying	710, 712	1	3	–	–

SECOND YEAR SUBJECTS COURSE 6	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Calculus	491	2	–	2	–
Chemical Laboratory	229	–	–	–	–
Economics	311	2	–	2	–
Electricity	332, 334	2	3	–	–
Elementary Machine Design	462	–	–	2	–
Engineering Problems and Drawing	287	–	3	–	6
German*	613	1	–	1	–
Hydraulics, Elementary	447	1	–	–	–
Industrial Chemistry A	230, 232	1	11	1	–
Industrial Chemistry B	231	–	–	1	–

*Students who cannot present Junior Matriculation certificates in German will be required to attend tutorial class, 1 hour per week, both terms (time to be taken from Chemical Laboratory), and to pass an examination in this language. Those who hold certificates will not be required to take this course.

SECOND YEAR SUBJECTS COURSE 6—*Continued*	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Inorganic Chemistry	223	1	–	1	–
Mechanics of Materials	23	2	–	2	–
Organic Chemistry	234, 235	2	–	2	10
Physical Chemistry	236	2	–	2	–
Physical Training	640	–	2	–	2

THIRD YEAR SUBJECTS COURSE 6	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Alternating Currents	340, 349	2	3	–	–
Assaying Laboratory	164	–	$1\frac{1}{2}$	–	–
Business	310	–	–	1	–
Chemical Engineering	242	2	–	–	–
Chemical Theory	240	–	–	2	–
Electrochemistry	246, 247	$1\frac{1}{2}$	$1\frac{1}{2}$	–	–
German	614	1	–	1	–
Heat Engines, Theory	421, 428	2	–	2	$1\frac{1}{2}$
Hydraulics	440, 441	2	$1\frac{1}{2}$	2	–
Industrial Chemistry	241, 238	1	–	1	$13\frac{1}{2}$
Metallurgy, Physical	546	–	–	1	–
Modern World History	324	1	–	1	–
Optics	72,73	1	–	1	3
Organic Chemistry	244, 245	2	$10\frac{1}{2}$	2	–
Political Science	323	1	–	1	–

FOURTH YEAR SUBJECTS COURSE 6	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Chemical Engineering Thermodynamics	248	1	–	1	–
Chemical Laboratory	251	–	15	–	–
Chemical Theory	259	1	–	2	–
Engineering Law	314	1	–	–	–
German	615	1	–	1	–
Industrial Management	318	1	–	1	–
Machine Design	469, 470	1	–	1	3
Modern Political and Economic Trends	325	1	–	1	–
Organic Chemistry	249	1	–	1	–
Philosophy of Science	326	1	–	½	–
Profession of Engineering	327	–	–	½	–
Public Speaking	320	1	–	1	–
Thesis	734	–	–	–	–
and *one of*					
1. Industrial Chemistry:					
Chemical Engineering Problems	252	–	1	–	3
Chemical Engineering	253	1	–	1	–
Industrial Chemistry	258	1	–	–	–
Research	254	–	5	–	16
2. Electrochemistry	255, 256	1	6	1	19
3. Physical Metallurgy	543, 544, 545	2	6	1	19
4. Glass Technology	570, 571	2	6	1	19
5. Zymology	750	–	8	–	20

ELECTRICAL ENGINEERING

(COURSE 7)

In following his profession, an electrical engineer will find necessary a knowledge of many fields in addition to that of applying things electrical for the benefit of humanity. For this reason the course includes not only mathematics, mechanics, physics and chemistry, but also heat engines, hydraulics, theory of mechanisms, machine design, business, economics, engineering law, and other non-electrical subjects.

In the electrical field much time is given to the calculation of circuits of electric, magnetic, and dielectric types, methods of measurement of various quantities in direct and alternating current circuits, theory of generators, motors, magnets, and other apparatus, design, electrical transmission of energy, and many related matters of interest. A great variety of problems for solution is one means of developing understanding. In the Fourth Year the proportion of time given to electrical engineering is much greater than in earlier years.

A training of this nature should, with subsequent experience, enable a student to develop into a useful and valued member of the profession, whether his natural abilities lead him into technical, commercial, or administrative responsibilities.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Analytical Geometry, 492, page 133.

PRACTICAL EXPERIENCE

Before receiving the degree, every student in Electrical Engineering is required to submit satisfactory evidence of having had 1200 hours' practical experience. (See subject 695.)

GRADUATE STUDY

Graduates of this University, or of another university of recognized standing, who have taken the above course, or one similar, and who have a satisfactory academic record may proceed with work leading to a graduate degree.

About one-half of the time will be devoted to subjects chosen from mathematics, physics, and the fundamentals of electrical engineering. The other half may be devoted to power, electronics, or communications.

Further information appears on page 213. The Calendar of the School of Graduate Studies should be consulted for details.

FIRST YEAR SUBJECTS COURSE 7	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry	492	1	1	2	1
Calculus	490	2	2	2	2
Chemistry	221, 222	2	–	2	6
Descriptive Geometry	270	1	–	1	–
Dynamics	21, 281	1	1	2	1
Electricity	330	2	–	2	–
Engineering and Society	322	1	–	1	–
Engineering Problems and Drawing	281	–	9	–	4
English	610	1	–	1	–
Mechanical and Thermal Measurements	448	–	–	2	–
Physical Training	640	–	2	–	2
Practical Experience	695	–	–	–	–
Statics	20, 281	1	1	2	1
Surveying	710, 712	1	3	–	–

SECOND YEAR SUBJECTS COURSE 7	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Applied Physics	70,71	1	3	1	3
Calculus	491	2	3	2	3
Descriptive Geometry	272	1	–	1	–
Dynamics	22	1	–	1	–
Economics	311	2	–	2	–
Electrical Fundamentals	333	2	–	2	–
Electrical Laboratory	334	–	–	–	6
Electricity	332	–	–	2	–
Elementary Heat Engines	420	1	–	–	–
Elementary Machine Design	462	–	–	2	–
Engineering Chemistry	226	1	–	1	–
Engineering Problems and Drawing	288	–	6	–	3
Hydraulics, Elementary	447	1	–	–	–
Mechanics of Materials	23, 31	2	3	2	–
Physical Training	640	–	2	–	2
Practical Experience	695	–	–	–	–

THIRD YEAR SUBJECTS COURSE 7	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Alternating Currents	341	2	–	2	–
Business	310	–	–	1	–
Direct Current Machines	339	2	–	–	–
Electrical Design	342	2	6	–	–
Electrical Problems and Seminar	343	–	3	–	3
Electrical Laboratory	344	–	6	–	3
Electronics	337	–	–	3	–
Heat Engines, Theory	421, 423	2	3	2	–
Hydraulics	440, 441	2	–	2	3
Machine Design	475, 468	2	–	2	3
Mathematical Applications in Electrical Engineering	336	–	–	3	–
Modern World History	324	1	–	1	–
Physical Metallurgy	533	–	–	2	–
Political Science	323	1	–	1	–
Practical Experience	695	–	–	–	–

FOURTH YEAR SUBJECTS COURSE 7	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Acoustics	98	1	–	–	–
Alternating Current Circuit Analysis	351	2	–	2	–
Alternating Current Machinery	353	2	–	2	–
Alternating Current Measurements	354	2	–	–	–
Communication	361, 362	2	3	2	3
Electrical Design	358	–	–	1	3
Electrical Laboratory	355	–	6	–	6
Electrical Transmission of Energy	352	2	–	–	–
Engineering Economics	313	–	–	1	–
Engineering Electronics	357	1	–	2	–
Engineering Law	314	1	–	–	–
Illumination	93, 94	1	$1\frac{1}{2}$	1	$1\frac{1}{2}$
Industrial Management	318	1	–	1	–
Modern Political and Economic Trends	325	1	–	1	–
Philosophy of Science	326	1	–	$\frac{1}{2}$	–
Practical Experience	695	–	–	–	–
Profession of Engineering	327	–	–	$\frac{1}{2}$	–
Seminar	359	–	3	–	3
Thesis	735	–	–	–	–

METALLURGICAL ENGINEERING

(COURSE 8)

The metallurgical engineer is concerned with the winning of metals from ores. Since virgin metals rarely possess useful physical properties, the second task of the metallurgist is to produce alloys, such as steel, which have suitable physical properties.

No other materials approach the metals in strength, and the whole fabric of modern civilization is dependent on their properties. The fields of employment for graduates lie in production metallurgical industries, the industries which fabricate metals, and in sales and research. Metallurgical research facilities have notably been increased in recent years in Canada.

The course is designed to give the student a firm grasp of the chemical fundamentals upon which metallurgical reactions are based. Engineering courses are provided to give a general knowledge of hydraulics, mechanics of materials, etc.

Courses in production metallurgy cover the theory and practice of winning aluminium, copper, iron, lead, magnesium, nickel, zinc, etc., from their ores. Physical metallurgy courses cover the production, heat treatment, microscopic and physical examination of alloys.

The subjects of instruction are shown in the following pages. In these tables, reference numbers have been assigned to the subjects referring to a more detailed description of each, e.g., Analytical Geometry 492, page 133.

GRADUATE STUDY

Graduates of this University, or of another university of comparable standing, who have taken the above course, or one similar, with a sufficiently good standing, may proceed with work leading to a graduate degree.

Students wishing to pursue further studies, whether in extractive metallurgy or physical metallurgy, may proceed in the Department of Metallurgical Engineering to the degrees M.A.Sc. and Ph.D.

A major part of the time will be spent on research work, while the remainder will be devoted to subjects chosen from Physics, Chemistry, Mining, Mineralogy and Metallurgy.

Further information appears on page 213 and in the Calendar of the School of Graduate Studies.

First Year Subjects Course 8	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry........	492	1	–	2	–
Calculus...................	490	2	–	2	–
Chemistry..................	221, 222	2	6	2	6
Descriptive Geometry.......	270	1	–	1	–
Dynamics...................	21	1	–	2	–
Electricity................	330	2	–	2	–
Engineering and Society......	322	1	–	1	–
Engineering Problems and Drawing................	282	–	8	–	7
English....................	610	1	–	1	–
Mechanical and Thermal Measurements...........	448	–	–	2	–
Mineralogy, Introductory....	581	–	–	1	1
Physical Training...........	640	–	2	–	2
Statics.....................	20	1	–	2	–
Surveying..................	710, 712	1	3	–	–

Second Year Subjects Course 8	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Alternating Currents........	331,350	1	–	1	3
Analytical Chemistry Laboratory..............	228	–	9	–	9
Calculus...................	491	2	–	2	–
Economics..................	311	2	–	2	–
Electricity................	332, 334	2	3	–	–
Elementary Machine Design..	462	–	–	2	–
Engineering Problems and Drawing................	289	–	3	–	3
Fuels and Combustion.......	531	1	–	1	–
Heat Engines, Elementary....	420	1	–	–	–
Hydraulics, Elementary......	447	1	–	–	–
Inorganic Chemistry........	223	1	–	1	–
Mechanics of Materials......	23	2	–	2	–
Metallurgy.................	530	1	–	–	–
Mining.....................	168	1	–	1	–
Physical Chemistry..........	236	2	–	2	–
Physical Training...........	640	–	2	–	2

THIRD YEAR SUBJECTS COURSE 8	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Chemistry	225	1	–	1	–
Assaying	160, 161	1	3	–	3
Business	310	–	–	1	–
Electrical Machinery	348	2	–	–	–
Electrochemistry	246, 247	$1\frac{1}{2}$	3	–	–
Heat Engine Practice	430	1	–	1	–
Heat Engines, Theory	427, 428	1	–	1	$1\frac{1}{2}$
Metallography Laboratory	537	–	3	–	3
Metallurgy	534, 535	2	6	1	6
Modern World History	324	1	–	1	–
Ore Dressing	175, 176	–	–	2	6
Physical Chemistry, Advanced	239	2	–	2	–
Physical Metallurgy	536	2	–	2	–
Political Science	323	1	–	1	–
Principles of Ore Dressing	181	2	–	–	–

FOURTH YEAR SUBJECTS COURSE 8	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Assaying	162, 163	–	–	1	3
Electrochemistry	255, 256	1	–	1	3
Engineering Economics	313	–	–	1	–
Machine Design	469, 470	1	–	1	3
Metallography Laboratory	544	–	3	–	3
Metallurgical Theory	550	1	–	1	–
Metallurgy	541, 542	1	6	1	2
Metallurgy Problems	540	2	–	2	–
Modern Political and Economic Trends	325	1	–	1	–
Ore Dressing	177, 178	1	6	1	–
Philosophy of Science	326	1	–	$\frac{1}{2}$	–
Physical Metallurgy	543, 545	2	3	2	–
Plant Management	317	–	–	1	–
Profession of Engineering	327	–	–	$\frac{1}{2}$	–
Thesis	736	–	2	–	7

CERAMIC ENGINEERING

(COURSE 8a)

The course in Ceramics offers a training for those who intend to work as engineers in the ceramic and industrial mineral industries. Ceramics deals with the preparation of raw materials for, and the manufacture and use of, such products as refractories, cement, heavy clay products, porcelain, pottery, glass and enamelled iron. Industrial mineral engineering includes the beneficiation and commercial utilization of minerals, not primarily used for the production of metals. Such minerals include asbestos, clay, diatomite, feldspar, gypsum, limestone, mica, quartz, talc, etc.

In the manufacture of fused silicates, such as glasses, glazes and enamels, both clear and coloured and in the manufacture of special bodies such as those used for thermal and electrical insulation, practically every chemical element obtainable on a commercial basis may be used. The subject matter is essentially inorganic chemical engineering with an emphasis upon high temperature chemistry. The natural field of employment for graduates would be for the technical, production and sales divisions of the industry.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, e.g., Analytical Geometry 492, page 133.

GRADUATE STUDY

Graduates of this University, or of another university of comparable standing, who have taken the above course, or one similar, with a sufficiently good standing, may proceed with work leading to a graduate degree. A part of the time will be devoted to subjects chosen from physics, chemistry and others approved by the School of Graduate Studies, while the remainder will be devoted to research in the same phase of the ceramic field.

Further information appears on page 213. The Calendar of the School of Graduate Studies should be consulted for further details.

FIRST YEAR SUBJECTS COURSE 8a	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry........	492	1	–	2	–
Calculus..................	490	2	–	2	–
Chemistry.................	221, 222	2	9	2	6
Descriptive Geometry.......	270	1	–	1	–
Dynamics..................	21	1	–	2	–
Electricity................	330	2	–	2	–
Engineering and Society......	322	1	–	1	–
Engineering Problems and Drawing................	283	–	5	–	7
English....................	610	1	–	1	–
Mechanical and Termal Measurements...........	448	–	–	2	–
Mineralogy, Introductory....	581	–	–	1	1
Physical Training...........	640	–	2	–	2
Statics....................	20	1	–	2	–
Surveying.............. ...	710, 712	1	3	–	–

SECOND YEAR SUBJECTS COURSE 8a	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Chemical Laboratory..............	228	–	12	–	11
Economics.................	311	2	–	2	–
Elementary Machine Design..	462	–	–	2	–
Electricity.................	332, 334	2	3	–	–
Engineering Problems and Drawing................	290	–	5	–	6
Fuels and Combustion.......	531	1	–	1	–
Hydraulics, Elementary......	447	1	–	–	–
Industrial Chemistry A.......	230	1	–	1	–
Industrial Chemistry B......	231	–	–	1	–
Inorganic Chemistry........	223	1	–	1	–
Mechanics of Materials......	23	2	–	2	–
Organic Chemistry..........	250	1	–	1	–
Physical Chemistry.........	236	2	–	2	–
Physical Training...........	640	–	2	–	2

THIRD YEAR SUBJECTS COURSE 8a	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Alternating Currents	340, 349	2	3	–	–
Assaying Laboratory	164	–	$1\frac{1}{2}$	–	–
Business	310	–	–	1	–
Ceramics	562	–	–	2	–
Ceramics Laboratory	564	–	$6\frac{1}{2}$	–	7
Chemical Engineering	242	2	–	–	–
Chemical Theory	240	1	–	1	–
Elementary Structural Engineering	29	1	–	1	–
Engineering Problems and Drawing	297	–	3	–	3
Heat Engines, Theory	421, 428	2	–	2	$1\frac{1}{2}$
Modern World History	324	1	–	1	–
Non-Metallic Minerals	560, 561	4	6	2	$8\frac{1}{2}$
Optical Mineralogy, Elementary	597	–	–	1	–
Physical Metallurgy	533	–	–	2	–
Political Science	323	1	–	1	–

FOURTH YEAR SUBJECTS COURSE 8a	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Ceramic Calculations	563	1	–	–	–
Economic Geology	402	–	–	2	–
Glass and Enamels	566	1	–	1	–
Hydraulics	440, 441	2	3	–	–
Industrial Management	318	1	–	1	–
Industrial Minerals Laboratory	568	–	9	–	6
Machine Design	469, 470	1	–	1	3
Modern Political and Economic Trends	325	1	–	1	–
Optical Mineralogy, Advanced, Laboratory	592	–	2	–	2
Ore Dressing Laboratory	180	–	3	–	3
Philosophy of Science	326	1	–	$\frac{1}{2}$	–
Plant Design	300	–	–	–	3
Principles of Ore Dressing	181	2	–	–	–
Profession of Engineering	327	–	–	$\frac{1}{2}$	–
Refractories and Ceramic Bodies	565	1	–	2	–
Silicate Chemistry	257	2	–	–	–
Thesis	737	–	3	–	6

MINING GEOLOGY

(COURSE 9)

The course in Mining Geology is designed to train more particularly those who wish to enter the field of applied geology, but it is sufficiently broad to provide training for work in any branch of geology, unless it be that in which an extensive knowledge of palaeontology is necessary.

The economic geologist is frequently brought into contact with engineering problems and it is essential that he receive a good grounding in those subjects, such as mathematics, mechanics, chemistry, physical sciences, surveying, and engineering drawing, that constitute the preliminary work in engineering courses. It is necessary that he understand something of the language and methods of the mining, metallurgical, and construction engineer with whom he must co-operate in his work around mines, dams, and other engineering works. The first two years of this course are the same as those in Mining Engineering, since that course provides the essential preliminary work, and some mining and metallurgy are taken in the other years to broaden the knowledge of the geologist in the work of those with whom he must co-operate.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Analytical Geometry, 492, page 133.

PRACTICAL EXPERIENCE

Before receiving the degree every student in Mining Geology, is required to submit satisfactory evidence of having had six months' practical experience. (See subject 696.)

GRADUATE STUDY

Graduates in the above course, or in a similar one in any university with standards comparable to this University, with a sufficiently good standing, may proceed with work leading to a higher degree.

Work for such degree will include the preparation of a thesis on an approved subject, together with the study of such subjects as advanced structural geology, economic geology, mining, metamorphism, and geophysics.

Further information appears on page 213. The Calendar of the School of Graduate Studies should be consulted for details.

FIRST YEAR SUBJECTS COURSE 9	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry	492	1	–	2	–
Calculus	490	2	–	2	–
Chemistry	221, 222	2	6	2	6
Descriptive Geometry	270	1	–	1	–
Dynamics	21	1	–	2	–
Electricity	330	2	–	2	–
Engineering and Society	322	1	–	1	–
Engineering Problems and Drawing	276	–	6	–	6
English	610	1	–	1	–
Mechanical and Thermal Measurements	448	–	–	2	–
Mineralogy, Elementary	580, 583	–	–	2	–
Mining Laboratory	165	–	2	–	–
Physical Training	640	–	2	–	2
Practical Experience	696	–	–	–	–
Statics	20	1	–	2	–
Surveying	710, 712	1	3	–	–

SECOND YEAR SUBJECTS COURSE 9	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Chemistry Laboratory	227	–	–	–	3
Alternating Currents	331, 350	1	–	1	3
Blowpipe Analysis	589	–	–	–	2
Chemistry	224	1	–	1	–
Descriptive Geometry	272	1	–	1	–
Economics	311	2	–	2	–
Engineering Problems and Drawing	285	–	8	–	8
General Geology	388, 389	2	–	1	2
Heat Engines, Elementary	420	1	–	–	–
Mechanics of Materials	23,31	2	–	2	3

SECOND YEAR SUBJECTS COURSE 9—*Continued*	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Mining	167	1	–	–	–
Optical Mineralogy, Elementary	597	–	–	1	–
Petrography, Elementary	587	1	–	–	1
Physical Training	640	–	2	–	2
Practical Experience	696	–	–	–	–
Problems and Seminar	186	–	2	–	–
Surveying	715, 716	1	6	1	–
Theory of Measurements	182	1	–	–	–

THIRD YEAR SUBJECTS COURSE 9	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Chemistry	225, 237	1	3	1	3
Assaying	160, 161	1	3	–	3
Business	310	–	–	1	–
Economic Geology	398, 400	1	3	3	3
Geological Field Work	380	–	–	–	–
Historical Geology	383, 384	2	2	2	2
Metallurgy	530	1	–	–	–
Mining	170	1	–	1	–
Modern World History	324	1	–	1	–
Petrography, Advanced	590, 591	1	2	1	2
Physical Chemistry	236	2	–	2	–
Physical Metallurgy	546, 549	–	–	1	1
Political Science	323	1	–	1	–
Practical Experience	696	–	–	–	–
Precambrian and Economic Geology Laboratory	397	–	–	–	2
Principles of Ore Dressing	181	2	–	–	–
Structural Geology	390, 391	2	3	–	3
Survey Camp	720	–	–	–	–

FOURTH YEAR SUBJECTS COURSE 9	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Engineering Economics	313	–	–	1	–
Geology of Canada	403, 404	2	–	1	2
Geology, Mining	393, 394	2	3	1	3
Geology, Pleistocene and Physiographic	381, 382	1	1	1	–
Geology, Precambrian	392	2	–	–	–
Geophysics	675, 671	2	6	2	6
Mine Management	172	2	–	–	–
Mineralography, Laboratory	593	–	2	–	2
Mining	166, 171	–	–	2	3
Modern Political and Economic Trends	325	1	–	1	–
Optical Mineralogy, Advanced, Laboratory	592	–	2	–	2
Practical Experience	696	–	–	–	–
Profession of Engineering	327	–	–	$\frac{1}{2}$	–
Philosophy of Science	326	1	–	$\frac{1}{2}$	–
Silicate Chemistry	257	2	–	–	–
Thesis	738	–	4	–	6

AERONAUTICAL ENGINEERING

(COURSE 10)

Admission to and promotion in this course is granted only to students who meet the special requirements set forth on pages 22 and 153 of this Calendar.

The course is designed to provide a sound training in mathematics and science in the First and Second Years, together with certain fundamental subjects pertaining to the practice of aeronautical engineering. In the Third and Fourth Years, training is provided in those subjects now generally recognized as belonging strictly to the design, construction, and operation of aircraft.

The training in this course is planned to fit graduates to enter the technical design staffs of aircraft manufacturing companies. In Canada and Great Britain, due to the necessary emphasis on mass production for war purposes, there is a shortage of personnel trained to enter design staffs. In both these countries there will be opportunities for graduates in Aeronautical Engineering when wartime mass production gives way to design for peacetime transportation aircraft.

Students desiring to enter the Third Year of this course must have had at least two hours of instructional flying.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Algebra and Calculus, 502, page 133.

GRADUATE STUDY

Graduates of this University, or of other Universities of comparable standing, who have taken the above mentioned or similar course with sufficiently high records may proceed with work leading to a graduate degree.

The time devoted to graduate study is divided between work on the subjects of mathematics, aerodynamics, and related subjects to the approved field of investigation chosen by the candidate.

Further information appears on page 213. The Calendar of the School of Graduate Studies should be consulted for details.

FIRST YEAR SUBJECTS COURSE 10	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Algebra and Calculus	502	3½	–	3½	–
Analytical Geometry	503	1½	–	1½	–
Applied Mechanics	24	2	–	2	–
Chemistry	221, 222	2	3	2	3
Descriptive Geometry	270	1	–	1	–
Electricity	330	2	–	2	–
Engineering and Society	322	1	–	1	–
Engineering Problems and Drawing	279	–	3	–	6
English	610	1	–	1	–
Physical Training	640	–	2	–	2
Properties of Matter; Mechanics and Heat	650, 651	4	3	4	3
Surveying	710, 712	1	3	–	–

SECOND YEAR SUBJECTS COURSE 10	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Aeronautics	11	–	–	½	–
Analytical Geometry of Space	506	1	–	1	–
Applied Physics	75, 76	1	3	1	3
Descriptive Geometry	272	1	–	1	–
Differential Calculus	504	3	–	3	–
Dynamics	25	1	–	1	–
Economics	311	2	–	2	–
Engineering Problems and Drawing	286	–	6	–	6
Heat	658, 659	1	3	–	–
Heat Engines, Elementary	420	–	–	2	–
Integral Calculus and Differential Equations	505	3	–	3	–
Mechanics of Materials	23, 31	2	–	2	3
Physical Training	640	–	2	–	2
Theory of Machines A	465	2	–	2	–

THIRD YEAR SUBJECTS COURSE 10	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Advanced Engineering Mechanics	27	1	–	1	–
Aeronautics	1	1	–	1	–
Aircraft Layout	12	–	–	–	3
Aircraft Structural Analysis	9, 10	1	3	1	3
Alternating Currents	340	2	–	–	–
Applied Elasticity	33	1	–	1	–
Differential Equations	509	1	1	1	1
Direct Current Machines	338	–	–	2	–
Elementary Structural Engineering	29	1	–	1	–
Heat Engines, Theory	421, 423	2	3	2	3
Hydrodynamics	662	1	–	1	–
Machine Design	467, 468	2	6	2	6
Modern World History	324	1	–	1	–
Political Science	323	1	–	1	–
Theory of Functions	508	1	1	1	1

FOURTH YEAR SUBJECTS COURSE 10	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Aerodynamics	3, 4	2	6	2	6
Aircraft Electricity	366	–	–	1	–
Aircraft Hydraulics	452	1	–	–	–
Aircraft Materials	551	1	–	1	–
Airplane Design and Layout	5, 6	2	9	2	9
Airplane Stress Analysis	7, 8	2	3	2	3
Differential Equations of Mathematical Physics	521	2	–	2	–
Internal Combustion and Aircraft Engines	425	1	–	1	–
Modern Political and Economic Trends	325	1	–	1	–
Philosophy of Science	326	1	–	$\frac{1}{2}$	–
Profession of Engineering	327	–	–	$\frac{1}{2}$	–
Theoretical Hydrodynamics	523	1	–	1	–
Theory of Elasticity	522	2	–	–	–
Thesis	739	–	–	–	–

ENGINEERING AND BUSINESS

(COURSE 11)

A substantial proportion of those who are admitted to the Faculty of Applied Science and Engineering have no particular interest in any one branch of technology, but desire a broad general training, preponderately engineering in character, that will fit them rather for executive or administrative positions, than for those of a purely technical or design nature. Many engineers nowadays occupy positions of responsibility in sales, production, purchasing, and other similar branches of industry, and for those who wish to enter such fields, the training offered should contain a greater proportion of economic, business, and management instruction than is possible in the distinctively technical courses.

The course in Engineering and Business is designed to cover that field and to be suitable for those who require such training. It is not expected that graduates from this course will immediately enter upon executive work; indeed, their early work may be almost entirely of a technical character, but it is anticipated that their ultimate tendency will be toward positions in the field of management or business. Their progress in that direction will depend largely on their own industry and abilities. Moreover, all engineers, whatever their duties may be, must be able to handle men as well as machines and their duties tend to become more and more administrative in character as they assume positions of increasing responsibility.

The subjects of instruction are shown in the following tables. In these tables, reference numbers have been assigned to the subjects referring to a more detailed description of each, e.g., Calculus 491, page 133.

Before receiving the degree, every student in Engineering and Business is required to submit satisfactory evidence that he has had practical experience satisfactory to the Committee administering the course.

Successful completion of the First Year of any course in the Faculty, except Architecture, will entitle a student to apply to enter the course in Engineering and Business, which commences with the Second Year.

For the Session 1946-47 the Second and Third Years only of the curriculum set out below will be offered.

Students desiring to enter the Second Year of the course are required to submit applications to do so to the Secretary of the Faculty not later than September 15th.

SECOND YEAR SUBJECTS COURSE 11	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Applied Physics	70, 71	1	3	1	3
Calculus	491	2	–	2	–
Descriptive Geometry	272	1	–	1	–
Direct Current Machines	338	–	–	2	3
Dynamics	22	1	–	1	–
Economics	311	2	–	2	–
Electricity	332, 334	2	3	–	–
Engineering Chemistry	233	1	–	1	–
Engineering Problems and Drawing	286	–	6	–	8
Heat Engines, Elementary	420	–	–	2	–
Hydraulics, Elementary	447	1	–	–	–
Industrial Chemistry A	230	1	–	1	–
Mechanics of Materials	23, 31	2	3	2	–
Physical Metallurgy	533	–	–	2	–
Physical Training	640	–	2	–	2
Practical Experience	698	–	–	–	–
Public Speaking	320	–	–	–	1

THIRD YEAR SUBJECTS COURSE 11	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Accounting and Statistics	307	3	2	3	2
Alternating Currents	340, 346	2	3	–	–
Applied Economics	308	2	–	2	2
Elementary Structural Engineering	29	1	–	1	–
Engineering Problems and Drawing	302	–	6	–	3
Heat Engines, Theory	421, 423	2	–	2	3
Hydraulics	440, 441	2	–	2	3
Industrial Management A	328	1	2	2	1
Machine Design	467, 468	2	3	2	3
Modern World History	324	1	–	1	–
Political Science	323	1	–	1	–
Practical Experience	698	–	–	–	–

FOURTH YEAR SUBJECTS COURSE 11	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Alternating Current Machinery	345, 346	–	–	2	3
Business Policy	309	2	3	3	4
Engineering Economics	313	–	–	1	–
Engineering Law	314	1	–	–	–
Heat Treatment of Iron and Steel	547, 548	1	–	1	1½
Illumination	93, 94	1	1½	1	1½
Industrial Management B	329	3	3	3	3
Manufacturing Processes	476, 477	2	3	2	3
Modern Political and Economic Trends	325	1	–	1	–
Philosophy of Science	326	1	–	½	–
Practical Experience	698	–	–	–	–
Profession of Engineering	327	–	–	½	–
Structural Engineering	46, 299	2	3	–	–
Thesis	740	–	2	–	2

OUTLINE OF LECTURE AND LABORATORY SUBJECTS

On the pages that follow a brief description is given of the lectures and laboratory subjects prescribed in the preceding tables of curriculum. The numbers before the subjects are the reference numbers assigned in the tables. For example, 20. Statics, means the course of lectures indicated by this number in the table of curriculum for the First Year on page 33.

AERONAUTICAL ENGINEERING

1. Aeronautics. T. R. Loudon.

Course 10, III Year; 1 hr. lecture per week, both terms.

An introductory course on the basic principles of aerodynamics and theory of flight. The elements of stability and control are discussed and the fundamental theory of performance estimation is outlined in these lectures.

Text books: Technical Aerodynamics—K. D. Wood. Aerodynamics of the Airplane—Millikan. Theory of Flight—Von Mises.

3. Aerodynamics. B. Etkin.

Course 10, IV Year; 2 hrs. lectures per week, both terms.

An advanced course in aerodynamic theory, in which the following topics are discussed: performance estimation and calculation, airfoil theory, propellors, wind tunnel corrections, drag, stability and control, spinning, rotary wing aircraft, compressibility effects.

Text books: Applied Aerodynamics—Bairstow. Airfoil and Airscrew Theory—Glauert. Aerodynamics of the Airplane—Millikan. Aerodynamics Theory—Durand.

4. Aerodynamics Laboratory. B. Etkin.

Course 10, IV Year; 6 hrs. laboratory per week, both terms.

This subject is intended to amplify the lecture course on hydrodynamics and aerodynamics. The calibration and practical use of wind tunnel instruments are explained, and experiments are carried out to illustrate the points discussed in the lectures.

5. Airplane Design and Layout. T. R. Loudon, B. S. Shenstone, J. W. Jakimiuk, W. Jackson.

Course 10, IV Year; 2 hrs. lectures per week, both terms.

Methods of application of aerodynamic theory and stress analysis to the design of airplanes are discussed. Problems are set for the laboratory periods in which actual airplane layouts are made and stressed for the required conditions in practice.

Text books: Air Ministry Publications 970 and 1208. C.A.M.-04. C.A.M.-05.

6. Airplane Design and Layout Laboratory. T. R. Loudon, B. S. Shenstone, W. J. Jakimiuk, W. Jackson.

Course 10, IV Year; 9 hrs. laboratory per week, both terms.

In this subject, the principles from the various lecture subjects on aerodynamics, stress analysis and layout are applied to the design of an aeroplane as a whole, and to its component parts. The British Air Ministry and U.S.A. conditions used in Canada are applied to these design problems.

7. Airplane Stress Analysis. T. R. Loudon.

Course 10, IV Year; 2 hrs. lectures per week, both terms.

An advanced course continuing the work of the Third Year on aircraft framed structures and stringer skin combinations. Shear flow in open and closed sections is discussed. Strain energy, the elastic centre and moment distribution methods are outlined. Simple and continuous beam columns are analyzed and various other structural problems encountered in aircraft design are taken up and problems worked out.

Text books: Airplane Structures—Niles and Newell. Airplane Structural Analysis and Design—Sechler and Dunn. Analysis and Design of Airplane Structures—Bruhn.

8. Airplane Stress Analysis. T. R- Loudon.

Course 10, IV Year; 3 hrs. laboratory work per week, both terms.

Problems are worked out using the theory explained in the lectures of subject 7. These problems all relate to aircraft.

9. Aircraft Structural Analysis. T. R. Loudon.

Course 10, III Year; 1 hr. lecture per week, both terms.

Elementary principles of advanced structural analysis used in aircraft design. Problems are set to be worked out in the laboratory.

Text books: Airplane Structures—Niles and Newell. Airplane Structural Analysis and Design—Sechler and Dunn. Analysis and Design of Airplane Structures—Bruhn.

10. Aircraft Structural Analysis Laboratory. T. R. Loudon, B. Etkin.

Course 10, III Year; 3 hrs. laboratory per week, both terms.

Problems based upon the lectures in subject 9 are worked out during these periods.

11. Aeronautics. T. R. Loudon.

Course 10, II Year; 6 lectures, second term.

An introductory course to the work of III Year Aeronautics (1).

12. Aircraft Layout. W. J. Jakimiuk, W. Jackson.

Course 10, III Year; 3 hrs. laboratory per week, second term.

Methods of layout and detailing peculiar to the aircraft industry.

APPLIED MECHANICS AND DESIGN OF STRUCTURES

20. Statics. T. R. Loudon.

Courses 1, 2, 3, 4, 6, 7, 8, 8a, and 9, I Year; 1 hr. lecture per week, first term; 2 hrs. lectures per week, second term.

Fundamental principles of the laws of equilibrium of forces are discussed. These principles are applied to the determination of stresses in simple structures. Toward the end of the subject an introduction to Mechanics of Materials is given.

Text book: Engineering Mechanics-Statics—Timoshenko and Young.

21. Dynamics. M. W. Huggins, B. Etkin.

Courses 1, 2, 3, 6, 7, 8, 8a, and 9, I Year; 1 hr. lecture per week, first term; 2 hrs. lectures per week, second term.

A subject designed to extend the elementary principles of preparatory school mechanics to a more general viewpoint. Under the heading of kinematics, the general equations of motion, both linear and angular, are developed.

Centres of mass and moments of inertia are calculated.

The principles of linear and angular momentum are dealt with and a fairly comprehensive course on effective and inertia forces as applied to engineering problems is given. The discussion of energy, work, and power is extended as far as possible to practical problems.

Simple harmonic motion is also discussed.

Text book: Principles of Physics, Mechanics—Sears.

22. Dynamics. I. W. Smith.

Courses 1, 3, 5, 7, and 11, II Year; 1 hr. lecture per week, both terms.

This subject extends the work of the First Year to more general applications, such as: bodies moving with general plane motion, compound pendulum, gyroscopic action.

Text books: Analytical Mechanics for Engineers—Seely and Ensign.

23. Mechanics of Materials. T. R. Loudon, R. F. Legget, M. W. Huggins.

All courses, II Year; 2 hrs. lectures per week, both terms.

In this subject, the fundamental theories of stress and strain are discussed and applied in the design of tension members, riveted joints, pipes and tanks, beams, columns, shafts, etc. A number of problems are worked out both in the lecture course and in the drafting room.

Text books: Resistance of Materials—Seely. Mechanics—Sears.

24. Applied Mechanics. B. Etkin.

Courses 5 and 10, I Year; 2 hrs. lectures per week, both terms.

This subject is divided into two parts: one dealing with the application of the principles of statics to elementary framed struc-

tures and simple beams, and the other dealing with the fundamental principles of dynamics of a particle extended eventually to consideration of rigid bodies.

Text books: Engineering Mechanics (Vol. 1)—Timoshenko and Young. Principles of Physics, Mechanics—Sears.

25. Dynamics. B. Etkin.

Course 10, II Year; 1 hr. lecture per week, both terms.

Introduction to vectors; general plane motion of particles systems of particles, and rigid bodies; compound pendulum, centre of percussion, gyroscopes.

Text books: Engineering Mechanics (vol. 2)—Timoshenko and Young. Principles of Mechanics—Synge and Griffiths.

27. Advanced Engineering Mechanics. B. Etkin.

Course 10, III Year; 1 hr. lecture per week, both terms.

Introduction to the operators curl, div. and grad. Plane and Space dynamics using the vector rotation. Euler's equation for a rigid body. Lagranges equations. Vibrations. Dimensional analysis and model testing.

Text books: Principles of Mechanics—Synge and Griffiths. Engineering Mechanics (vol. 2)—Timoshenko and Young.

28. Elementary Structural Engineering. C. F. Morrison.

Course 1, III Year; 2 hrs. lectures per week, both terms.

An elementary study of the stress analysis and design of structures, structural members, and their details. Problems in analysis and design are worked out in the lectures and in the drafting room.

The work in the first term includes a discussion of tension members, steel and timber columns, simple and continuous beams, box girders, and plate girders. Welding as a method of connecting structural steel members is studied.

The second term is given chiefly to moving loads, the design of a riveted truss highway span, and the theory of railway truss spans.

Text books: Theory of Simple Structures—Shedd and Vawter. Structural Problems—Young. Steel Construction Handbook—A.I.S.C.

29. Elementary Structural Engineering. M. W. Huggins, W. H. M. Laughlin.

Courses 2, 3, 5r, 8a, 10, and 11, III Year; 1 hr. lecture per week, both terms.

Practically the same work as that for subject 28 in the first term.

30. Structural Design, C. F. Morrison.

Course 4, III Year; 2 hrs. lectures and 3 hrs. problems per week, both terms.

The stress analysis and design of elementary structures and structural members of timber, steel and reinforced concrete are studied

in this subject. Practical problems on the design of beams, columns, piers, footings, and roof trusses are worked out in the drafting room. Some time is spent testing and determining the physical properties of structural materials.

Reference books: Architectural Construction—Gay and Parker. Design of Steel Buildings—Hauf. Elementary Structural Engineering—Urquhart and O'Rourke.

31. Mechanics of Materials: General. T. R. Loudon, W. L. Sagar, C. E. Helwig.

Courses 1, 2, 5, 9 and 10, II Year; 3 hrs. laboratory per week, second term.

Courses 3, 7, and 10, II Year; 3 hrs. laboratory per week, first term.

An introduction to the experimental study of the strength and elasticity of engineering materials. In it he should acquire a first hand knowledge of the properties of certain common materials of construction, and some familiarity with the manner in which they might be expected to behave when subjected to loads.

Reference book: Junior Laboratory Course in Mechanics of Materials, Department of Civil Engineering; Municipal and Structural.

33. Applied Elasticity. M. W. Huggins.

Courses 1 and 10, III Year; 1 hr. lecture per week, both terms.

A study of the stresses and strains in structural materials and members. The topics treated include: members subjected to direct stress, shear stress, and flexural stress, and their resulting deformations; principal stresses; statically indeterminate structures such as continuous and fixed-end beams; the moment-area theorems; photo-elasticity as a method of determining stress intensity.

Reference books: Elements of Strength of Materials—Timoshenko and MacCullough. Applied Elasticity—Timoshenko and Lessels.

34. Applied Elasticity. M. W. Huggins.

Course 1a, IV Year; 1 hr. lecture per week, both terms; 3 hrs. problems per week, first term; 2 hrs. problems per week, second term.

A study of deformations and stresses in the following: beams on elastic foundations; concrete water tanks; heads of steel tanks; streets, both uniform and tapered subject to axial and side loads; curved beams. Problems based on the work covered in the lectures are worked out in the computing period by analytical, photoelastic, and Begg's deformeter method.

Reference books: Strength of Materials, Vols. I and II—Timoshenko.

35. Cements and Concrete. W. L. Sagar, C. E. Helwig.

Course 1, III Year; 1 hr. lecture per week, both terms.

The work in the first term includes a discussion of the cements used in construction, Portland cement in particular, and a study of the basic principles of concrete making.

In the second term the elements of the theory of reinforced concrete are discussed and examples are considered in the design of slabs, beams, and columns.

Text books: Plain Concrete—Bauer. Chemistry of Cement and Concrete—Lea and Desch. Reinforced Concrete Design—Sutherland and Clifford. Reinforced Concrete Construction, Vol. I—Hool. Elementary Structural Engineering—Urquhart and O'Rourke.

36. Theory of Structures. C. F. Morrison.

Course 1, IV Year; 1 hr. lecture per week, both terms.

The stress analysis of simple span, continuous, and cantilever trusses. Influence lines and index stresses. Truss deflections by analytical and graphical methods. Arches, suspension bridges, and statically indeterminate structures.

Text books: Theory of Simple Structures—Shedd and Vawter. Theory of Modern Steel Structures, Vol. II—Grinter.

37. Advanced Structural Analysis. M. W. Huggins, C. F. Morrison.

Course 1a, IV Year; 1 hr. lecture, 2 hrs. problems per week, both terms.

The analysis of statically indeterminate structural problems, with particular reference to the following: flexural deflections by single and double integration, by moment areas, shear areas, elastic weights, dummy loads, and Castigliano's first theorem; the slope-deflection method; the moment-distribution method; the method of least work and the column analogy.

Reference book: Theory of Modern Steel Structures, Vol. II—Grinter.

38. Mechanics of Materials: General. T. R. Loudon, W. L. Sagar, C. E. Helwig.

Course 1, IV Year; 3 hrs. laboratory per week, both terms.

Practice in investigating the elastic and physical properties of iron, steel, concrete, timber, etc., and the use of instruments of precision designed for this purpose.

Reference book: Materials of Construction—Johnson.

39. Foundations and Retaining Walls. R. F. Legget.

Courses 1 and 4, IV Year; 1 hr. lecture per week, both terms.

A study of the necessity for accurate knowledge of sub-surface conditions as a preliminary to all foundation, retaining wall and

dam design serves to introduce this course which deals with methods of sub-surface exploration, and the elements of the design of foundation units, bridge piers, and retaining walls of concrete and of steel. Attention is paid to relevant constructional requirements.

40. Soil Mechanics. W. L. Sagar, R. F. Legget.

Course 1, IV Year; 1 hr. lecture per week, first term.

A subject devoted to those physical and mechanical properties of soils of importance to the engineer, such as compressive and cohesive strengths, internal friction, stability in slopes, compressibility and other deformational characteristics, permeability and moisture retention. The bearing of these properties on the design and construction of engineering works is considered in detail.

Reference books: Engineering Properties of Soil—Hogentogler. Notes on Soil Mechanics and Foundations—Plummer.

41. Reinforced Concrete. C. F. Morrison.

Course 1, IV Year; 1 hr. lecture per week, both terms.

The theory of the strength of reinforced concrete elements, including the beam, the slab, the T-beam, the column, and the girderless floor, is continued in this subject.

The analysis of the monolithic arch by the elastic theory is discussed, and the student is required in the drafting room to apply his knowledge to the design of simple structures.

Reference books: Design of Concrete Structures—Urquhart and O'Rourke. Reinforced Concrete Design—Sutherland and Reese.

42. Structural Design. C. F. Morrison.

Course 4, IV Year; 1 hr. lecture and 3 hrs. problems per week, both terms.

The study of the analysis and design of structural members and structures is continued in this subject. The lectures are supplemented by problems assigned in the drafting room. These problems include the preparation of drawings showing the structural framing and details for various buildings.

43. Structural Design. C. F. Morrison, W. H. M. Laughlin.

Course 1, IV Year; 2 hrs. lectures per week, first term; 1 hr. lecture per week, second term.

Consideration is given to the various types of industrial buildings and other structures, the conditions governing their choice, and the design and details of construction in different materials. Examples in design are worked out in the class and drafting rooms illustrating such points as: economic arrangement of building frames, probable loadings for girders and columns, column eccentricities, wind loading, wind bracing, rigid frames, crane runways, cableways, headframes, tanks and towers.

Reference books: Handbook of Building Construction—Hool and Johnson. Architects' and Builders' Handbook—Kidder-Parker. Steel Mill Buildings—Ketchum.

44. Mechanics of Materials: Concrete. T. R. Loudon, W. L. Sagar, C. E. Helwig.

Course 1, III Year; 2 hrs. laboratory per week, first term.

Fundamentals in the design of sound concrete, including acceptability tests on the materials used in making concrete, experiments to show the effect on the consistency and strength of the concrete caused by variations in the quantities of the ingredients, and the design of an economical mix for a given set of conditions.

Reference books: Design and Control of Concrete Mixtures—Portland Cement Association. Materials Testing—Gilkey, Murphy, Bergman.

46. Structural Engineering. C. F. Morrison.

Courses 3 and 11, IV Year; 2 hrs. lectures per week, first term.

A study is made of various types of industrial buildings and other structures. Methods of analysis and examples in design are considered, involving the use of timber, structural steel, and reinforced concrete.

Reference books: Elementary Structural Engineering—Urquhart and O'Rourke. Steel Mill Buildings—Ketchum. Handbook of building Construction—Hool and Johnson.

47. Structural Design. C. F. Morrison.

Course 4, V Year; 1 hr. lecture and 3 hrs. problems per week, both terms.

In this subject some of the more advanced work in reinforced concrete is studied, including flat slab construction, panels reinforced in two directions, rigid frames and arches. In the drafting room the students apply the principles of structural design to problems in which actual buildings are designed and detailed.

50. Mechanics of Materials: Soils and Highway. W. L. Sagar, R. F. Legget, C. E. Helwig.

Course 1, IV Year; 3 hrs. laboratory per week, second term.

Experiments relating to the physical properties of rocks such as are used in road building, and bituminous materials as used in road and airport construction. Physical and mechanical characteristics of soils, related to highway and foundation work, are investigated in a series of experiments that provide an introduction to practical Soil Mechanics.

Reference books: Construction of Roads and Pavements—Agg. Specifications—Dept. of Highways, Ontario. Soil Mechanics—Krynine.

APPLIED PHYSICS

70. Applied Physics. V. L. Henderson.

Courses 7 and 11, II Year; 1 hr. lecture per week, both terms.

Correlating the physical principles of light, heat, sound, and vibration with problems in engineering, emphasizing the importance of the analytical approach.

Reference books: Fundamental Principles of Physics—Heil and Bennett. Introduction to Physical Optics—Robertson.

71. Applied Physics Laboratory. V. L. Henderson.

Courses 7 and 11, II Year; 3 hrs. laboratory per week, both terms.

Supplementing subject 70.

72. Optics. K. B. Jackson.

Course 6, III Year; 1 hr. lecture per week, both terms.

Light, geometrical and physical optics, and optical instruments pertaining to chemical engineering.

Text books: Optical Methods of Chemical Analysis—Gibb. Elements of Optics—Valasek.

73. Optics Laboratory. K. B. Jackson.

Course 6, III Year; 3 hrs. laboratory per week, second term.

Supplementing subject 72.

75. Applied Physics. E. L. Dodington.

Courses 1 and 10, II Year; 1 hr. lecture per week, both terms.

Correlating the physical principles of light, heat, sound and vibration with problems in engineering, emphasizing the importance of the analytical approach.

Reference book: Handbook of Engineering Fundamentals—Eshbach.

76. Applied Physics Laboratory. E. L. Dodington.

Courses 1 and 10, II Year; 3 hrs. laboratory per week, both terms.

Supplementing subject 75.

77. Photography. K. B. Jackson.

Course 4, II Year; 1 hr. lecture per week, first term.

The principles of photography, photographic equipment, materials, and processes, with special reference to architectural photography.

Reference books: Elementary Photography—Quarles. Fundamentals of Photography—Boucher.

78. Photography Laboratory. K. B. Jackson.

Course 4, II Year; 3 hr. laboratory per week, first term.

Supplementing subject 77.

79. Photometry. K. B. Jackson, E. L. Dodington.

Courses 5c, 5i, and 5s, III Year; 1 hr. lecture per week, second term.

Photometry, and the use of photography as a scientific implement.

80. Photometry. E. L. Dodington.

Courses 5c, 5s, and 5i, III Year; 3 hrs. laboratory per week, second term.

Supplementing subject 79.

81. Photographic Surveying. K. B. Jackson.

Course 1, III Year; 1 hr. lecture per week, first term.

An introduction to the methods and applications of terrestrial and aerial photographic surveying.

82. Photographic Surveying. K. B. Jackson.

Course 1b, IV Year; 2 hrs. lectures per week, first term.

Photogrammetric optics, surveying, cameras, photographic materials and processes. Terrestrial and aerial photography. Radial plotting methods, mosaics, stereoscopic methods. Mapping from oblique photographs. Applications.

83. Photographic Surveying Laboratory. K. B. Jackson, S. H. deJong.

Course 1b, IV Year; 5 hrs. laboratory per week, first term.

Supplementing subject 82.

85. Light and Acoustics. V. L. Henderson.

Course 4, III Year; 1 hr. lecture per week, both terms.

Production and propagation of sound, the control of reverberation, sound transmission through partitions, and vibration insulation; and an elementary course in the production of light, and the measurement of light and electricity, in preparation for subject 87.

Reference book: Acoustics of Buildings—Watson.

86. Light and Acoustics Laboratory. V. L. Henderson.

Course 4, III Year; 2 hrs. laboratory per week, both terms.

Supplementing subject 85.

87. Illumination Design. E. L. Dodington.

Course 4, IV Year; 1 hr. lecture per week, both terms.

Control of light distribution, the computation of illumination and brightness, and the design of lighting installations for public and private buildings.

88. Illumination Design Laboratory. E. L. Dodington.

Course 4, IV Year; 1 hr. laboratory per week, both terms.

Supplementing subject 87. By co-operation with the staff of the School of Architecture, problems in lighting design and acoustics will form a part of certain problems in architectural design in subjects 123, 124, and 125.

89. Architectural Acoustics. V. L. Henderson.

Course 5i, IV Year; 1 hr. lecture per week, first term; 3 hrs. lectures per week, second term.

Design of buildings for good acoustics, the calculation and measurement of the acoustical properties of buildings and materials, and the treatment of buildings to improve their acoustical properties and to control the nuisance of noise.

90. Architectural Acoustics Laboratory. V. L. Henderson.

Course 5i, IV Year; 3 hrs. laboratory per week, first term; 9 hrs. laboratory per week, second term.

Supplementing subject 89.

93. Illumination. V. L. Henderson.

Courses 7 and 11, IV Year; 1 hr. lecture per week, both terms.

Illuminating Engineering dealing with the production and measurement of light and colour, and the theory and design of lighting equipment and installations.

Reference books: Scientific Basis of Illuminating Engineering—Moon. Illuminating Engineering—Boast.

94. Illumination Laboratory. V. L. Henderson.

Courses 7 and 11, IV Year; 3 hrs. laboratory alternate weeks, both terms.

Supplementing subject 93.

95. Photometry and Illumination Design. K. B. Jackson, V. L. Henderson.

Course 5i, IV Year; 2 hrs. lectures per week, both terms.

Measurements of luminous intensity, luminous flux, illumination, brightness, reflection, transmission, absorption, diffusion, and colour by visual and physical methods; and on the design and application of illuminating engineering equipment.

96. Photometry and Illumination Design Laboratory. K. B. Jackson, V. L. Henderson.

Course 5i, IV Year; 6 hrs. laboratory per week, both terms.

Supplementing subject 95.

97. Acoustics. V. L. Henderson.

Courses 5c and 5s, IV Year ; 1 hr. lecture per week, first term.

Acoustics of electrical sound systems; including sound waves, hearing, the mechanical-electrical-acoustical analogy, microphones, loud speakers, etc.

Reference books: Elements of Acoustical Engineering—Olson. Applied Acoustics—Olson and Massa.

98. Acoustics. V. L. Henderson.

Course 7, IV Year; 1 hr. lecture per week, first term.

This subject deals with the properties of acoustical elements, particularly with their application in electrical sound systems.

Reference books: Elements of Acoustical Engineering—Olson. Applied Acoustics—Olson and Massa.

99. Vibration Engineering. V. L. Henderson.

Course 5r, IV Year; 1 hr. lecture per week, both terms.

Vibrating systems with one degree of freedom. Electrical analogues and impedance methods. Systems with more than one degree of freedom. Application to machines and structures. Instrumental methods.

100. Vibration Laboratory. V. L. Henderson, M. J. C. Lazier.

Course 5r, IV Year; 3 hrs. laboratory per week, both terms.

A series of experiments designed to give familiarity with the nature of vibrating systems and the causes, measurement, and control of vibration in engineering problems.

ARCHITECTURE, DRAWING, AND PAINTING

110. History of Architecture. A. P. C. Adamson.

Course 4, I Year; 1 hr. lecture per week, both terms.

Development of architecture, traced from earliest times to the close of the Byzantine Period.

Reference books: A Short Critical History of Architecture—H. Heathcote Statham. The Architecture of Ancient Greece—Anderson, Spiers, and Dinsmoor. The architecture of Ancient Rome—Anderson, Spiers, and Ashby. The Grammar of Ornament—Owen Jones.

111. History of Architecture. A. P. C. Adamson.

Course 4, II Year; 1 hr. lecture per week, both terms.

In this subject the development of architecture is traced from the Romanesque Period to the end of the Gothic Period.

Reference books: A Short Critical History of Architecture—H. Heathcote Statham. Medieval Architecture—Arthur Kingsley Porter. Gothic Architecture in England—Francis Bond. The Grammar of Ornament—Owen Jones.

112. History of Architecture A. H. H. Madill.

Course 4, III Year; 1 hr. lecture per week, first term.

In this subject the architecture of the Renaissance in Italy and France is studied with special reference to planning and composition.

Reference books: Architecture of the Renaissance in Italy—Anderson and Stratton. The Architecture of the Renaissance in France, Vols. I and II—W. H. Ward. The Renaissance of Roman Architecture—T. G. Jackson. Architecture Through the Ages—Hamlin.

113. History of Architecture B. E. R. Arthur.

Course 4, III Year; 1 hr. lecture per week, both terms.

This series of lectures is divided into two parts. During the first term Renaissance architecture of England is examined along with the social history of the period. The second term includes a study of the various art movements and the engineering of the 19th century, followed by a study of the modern movement during the 20th century.

Reference books: Growth of the English House—J. Alfred Gotch. A History of Renaissance Architecture in England, Vol. 1 and 2—R. Blomfield. History of the English House—N. Lloyd. Space, Time and Architecture—S. Giedion. English Social History—G. M. Trevelyan. Modern Building—W. C. Behrendt. Pioneers of the Modern Movement—Nikolaus Pebsner.

115. Functional Requirements of Buildings. J. A. Murray and others.

Course 4, III Year; 1 hr. lecture per week, both terms.

In this subject the principles underlying the planning of such buildings as churches, theatres, office buildings, etc., are discussed in detail.

116. Garden Design. H. B. Dunington Grubb.

Course 4, III Year; Special lectures, first term.

In this subject the historical development of Garden Design is traced from earliest times; the study of sites; the influence of topography, orientation, access, etc., on the problems of design; site planning; the location of buildings; the solution of an actual problem on a typical site.

117. Town Planning. A. P. C. Adamson, J. A. Murray.

Course 4, V Year; 1 hr. per week, second term.

The social and technical history of the town from ancient to modern times is studied. This is followed by consideration of planning organizations and offices, and general planning procedure, including basic data and studies. Plan types of residential, industrial, commercial, institutional, and recreational areas are studied. Modern plans and planning reports are investigated and the course concludes with planning as a political science.

118. Elements of Architectural Form. E. R. Arthur.

Course 4, I Year; 1 hr. lecture per week, both terms.

Introductory lectures leading to composition and planning in later years. Form, scale and proportion are studied. Simple domestic plans are discussed, and elements of design are examined in relation to actual buildings. These elements include windows, doors, roofs, texture, materials, etc.

Reference books: Theory and Elements of Architecture, Vol. 1, Part I—Robert Atkinson and Hope Bagenal. Design—P. E. Nobbs. Design this Day—W. D. Teague.

119. History of Painting. R. H. Hubbard.

Course 4, IV Year; 1 hr. lecture per week, both terms.

An outline of the history and development of painting and of the minor pictorial arts from the earliest time until the present day.

120. History of Sculpture. R. H. Hubbard.

Course 4, III Year; 1 hr. lecture per week, first term.

History of architectural sculpture, including the modern.

121. Architectural Drawing. H. H. Madill, W. E. Carswell.

Course 4, I Year; 14 hrs. studio per week, first term; 15 hrs. studio per week, second term.

The course commences with instruction in drafting and lettering. It becomes the drafting room component of a number of subjects in the curriculum, including mathematics, applied mechanics, forms and details of elementary construction, isometric and perspective drawing. An elementary design is attempted toward the end of the year.

122. Architectural Design. H. H. Madill, E. R. Arthur, J. A. Murray.

Course 4, II Year; 15 hrs. studio per week, first term; 21 hrs. studio per week, second term.

This subject is given by means of individual instruction in the studio, and by criticism of the solutions of different problems set during the year. It is in this subject that the student begins the serious study of design; continued practice in architectural drawing and rendering affords the training necessary to make the student a more proficient draughtsman. Basic problems studied in this Year include simple residential and institutional buildings. One problem is carried through to working drawings in masonry or wood.

123. Architectural Design. H. H. Madill, E. R. Arthur, J. A. Murray.

Course 4, III Year; 15 hrs. studio per week, first term; 18 hrs. studio per week, second term.

This subject is given by individual instruction in the studio and by criticism of solutions of problems set during the year. The greater part of the subject is devoted to problems in design and forms a continuation of the subject given in the preceding year.

Basic problems studied in this Year include commercial and industrial buildings. One problem is carried through to working drawings in steel construction.

124. Architectural Design. H. H. Madill, E. R. Arthur, J. A. Murray.

Course 4, IV Year; 17 hrs. studio per week, both terms.

A continuation of the work of the preceding years, given by individual instruction in the studio and criticisms of the solution of problems set during the year. Basic problems studied in this Year include interior design and furniture, alterations, complex residential or institutional buildings. One problem is carried through to working drawings in concrete construction.

125. Architectural Design. H. H. Madill, E. R. Arthur, J. A. Murray.

Course 4, V Year; 23 hrs. studio per week, first term; 25 hrs. studio per week, second term.

More advanced problems in design are studied and a major design thesis is carried through completely from sketches to working drawings and specifications.

128. Theory of Architectural Planning. J. A. Murray.

Course 4, II Year; 1 hr. lecture per week, both terms.

The general principles of planning of buildings from the small to complex problems. In the second term actual plans of libraries, banks, houses, etc., are studied as an aid to problems in design and a preliminary to work in the following years.

The discussions include planning methods, technical factors influencing architectural design, basic principles of massing, composition, proportion and scale.

Reference books: Elements of Form and Design in Classic Architecture—Arthur Stratton. The Modern House—F. R. S. Yorke. The Smaller English House of the Later Renaissance, 1660-1830—A. E. Richardson and H. D. Eberlein. The Plan Requirements of Modern Buildings—V. O. Rees.

130. Housing. E. R. Arthur.

Course 4, IV Year; 1 hr. lecture per week, first term.

This series deals with housing for sale or rent, but is concerned mainly with the lower income groups. The study includes financing, planning, land acquisition and housing legislation in Canada and the United States. The lectures are illustrated. Following the lectures a problem in design is set in the drafting room.

Reference books: Europe Rehouses—Elizabeth Denby. Modern Housing—Catherine Bauer. Report of the committee on Housing and Community Planning No. 4, The Seven Myths of Housing—Nathan Straus.

131. Freehand Drawing and Water Colour Painting. W. E. Carswell.

Course 4, I Year; 2 hours studio per week, both terms.

Drawing from still life, primary freehand perspective, primary pencil, charcoal, and pen and ink rendering.

132. Freehand Drawing, Water Colour Painting, and Rendering. W. E. Carswell.

Course 4, II Year; 2 hrs. studio per week, both terms.

Drawing and painting from still life, drawing from the cast in pencil, pen and ink, and wash rendering. Primary water colour, drawing from landscape and pictorial composition.

In addition to the periods set out above, instruction is given in the studios in rendering (wash, charcoal, and other mediums), as problems in design approach completion.

Students are required to attend a course in field sketching at the University Survey Camp during the last week in September.

Students will report at the Camp on the date shown on page 5.

133. Freehand Drawing, Water Colour Painting, and Rendering. W. E. Carswell.

Course 4, III Year; 2 hrs. studio per week, both terms.

Drawing from the cast, water colour from still life, water colour rendering, drawing from landscape and natural objects.

Students who are sufficiently advanced are admitted to the Fourth Year Life Drawing Class.

In addition to the periods set out above, instruction is given in the studios in rendering (wash, charcoal and other mediums), as problems in design approach completion.

Students are required to attend a course in field sketching at the University Survey Camp during the last week in September.

Students will report at the Camp on the date shown on page 5.

134. Freehand Drawing, Water Colour Painting and Rendering. W. E. Carswell.

Course 4, IV Year; 2 hrs. studio per week, both terms.

Abstract design, colour composition, and drawing from life.

In addition to the periods set out above, instruction is given in the studios in rendering (wash, charcoal, and other mediums), as problems in design approach completion.

Students are required to attend a course in field sketching at the University Survey Camp during the last week in September.

Students will report at the Camp on the date shown on page 5.

136. Colour. W. E. Carswell.

Course 4, II Year; 1 hr. lecture per week, first term.

This subject is intended to assist the student in an appreciation of the value of colour and its application to architecture. Colour in period and modern rooms, the effect of sunlight and shade on colour, and differences in treatment in domestic, civic and institutional buildings are examined in class and on the boards. Theory of colour is discussed and the student is made familiar with such modern systems as those of Ostwald and Munsell.

137. Modelling. Frederick Coates.

Course 4, II Year; 2 hrs. studio per week, both terms.

Scale models of architectural forms.

138. Modelling. Frederick Coates.
Course 4, III Year; 2 hrs. studio per week, both terms.
Scale models of simple buildings.

139. Modelling. Frederick Coates.
Course 4, IV Year; 2 hrs. studio per week, both terms.
Scale models of buildings and settings.

140. Building Construction. H. H. Madill.
Course 4, I Year; 1 hr. lecture per week, second term.
Instruction is given in elementary construction using common building materials including the detailing of doors, windows, roofs, fireplaces, stairs, etc.
Reference books: Architectural Building Construction, Vol. 1—Jaggard and Drury. Building Construction, Vol. I—V. F. Mitchell.
Architectural Graphic Standards—Ramsey and Sleeper.

141. Building Materials: Architectural Application. H. H. Madill.
Course 4, IV Year; 1 hr. lecture per week, second term.
Properties and the use of the various materials used in building are studied from the architectural rather than the structural viewpoint.
A small exhibition room has been set aside in which examples of the most modern materials and devices are displayed. This room is open to the student at all times.
Reference books: Architectural Construction, Vol. I—Voss and Henry. Brickwork—W. R. Jaggard. Materials and Methods of Architectural Construction—Gay and Parker. Building Construction—W. C. Huntington.

142. Sanitary Science. H. H. Madill.
Course 4, IV Year; 1 hr. lecture per week, both terms.
Modern plumbing, its design and installation, drainage, sewage disposal and water supply.
Reference books: Mechanical and Electrical Equipment for Buildings—Gay and Fawcett.

143. Professional Practice. H. H. Madill.
Course 4, V Year; 1 hr. lecture per week, both terms.
This subject is designed to give an understanding of the professional character of the practice of architecture. In it are discussed the ethical, business, and legal relations of the architect to clients, contractors, craftsmen, engineers, and the professional bodies. The customs of office practice are also discussed.

Reference books: Architectural Practice and Procedure—H. H. Turner. The Architects Law Manual—C. H. Blake. The Law of Architecture and Building—C. H. Blake. Handbook of Architectural Practice A.I.A. Contact Forms of R.A.I.C. Engineering Law—Laidlaw and Young. Architects' Specifications—Goldsmith.

144. Heating and Air Conditioning. F. G. Ewens.

Course 4, V Year; 1 hr. lecture per week, both terms.

Instruction in methods of heat transfer, principles of design of steam, hot water and warm air heating systems, the use of the psychrometric chart, and design of ventilation and air conditioning systems.

Textbook: Heating and Air Conditioning—Allen and Walker.

145. Architectural Economics. W. S. Wilson.

Course 4, V Year; 1 hr. lecture per week, both terms.

Instruction in the various methods of preparing estimates, together with practical work in taking off quantities. Comparative costs of various types of materials and construction.

Building finance, revenue, and expenditure are also discussed.

147. Measured Drawings. E. R. Arthur.

Course 4, III Year.

Each student is required to submit, not later than the day of registration, a set of measured drawings of an existing building, along with the record of measurements and sketches neatly arranged in a note book. The subjects must be approved before measuring is begun. The study is marked as a separate subject, on the same basis as term work.

148. Outdoor Sketches. W. E. Carswell.

Course 4, IV Year.

Each student is required to submit, on or before the opening day of the session, a set of at least seven outdoor sketches in water colour, pen and ink, or pencil. The minimum size for each sheet will be 9″ × 12″. Of these sketches at least four will be in pencil and at least three will be of an architectural character.

ASSAYING, MINING, AND ORE DRESSING

The work in Mining is designed to give a thorough training in the underlying principles of Mining in its various branches, including exploration, development, and production. Special attention is paid to the practical and business aspects of these subjects.

The teaching of assaying has a two-fold function. The first is to give the student a working knowledge of the practice of the art, so that he can earn money as an assayer, upon graduation, and use this as a stepping-stone to other positions. The second is to use the assaying laboratories for the training of students in certain

important phases of engineering methods. The size of the apparatus, the completeness of the processes in short intervals of time, the extreme accuracy of results when so desired, the relation of the extent of error to time and method, the similarity of the academic laboratory to the field laboratory—all these permit an unrivalled opportunity for driving home much broad engineering philosophy. The assaying processes and apparatus lend themselves peculiarly well to the development of a proper perspective in regard to errors and accuracy in measurements.

160. Assaying.

Courses 2, 8, and 9, III Year; 1 hr. lecture per week, first term.

Theory and practice of fire assaying. Emphasis is laid not only upon the principles of chemistry, metallurgy and sampling involved, but also upon the errors inherent in operators as well as in methods.

References: Manual of Fire Assaying—Fulton and Sharwood. Textbook of Fire Assaying—Bugbee. Fire Assaying—Shepherd and Dietrich.

161. Assaying Laboratory.

Courses 2, 8, and 9, III Year; 3 hrs. laboratory per week, both terms.

Determination of precious metals. Some lecture instruction is given. Scorification and crucible assays of ores, pure and impure; and of milling and metallurgical products, including cyanide solutions. Buckboard practice on ores with metallics is given. Students are expected to do their later assays with despatch and a reasonable degree of accuracy.

162. Assaying.

Courses 2 and 8, IV Year; 1 hr. lecture per week, second term.

A continuation of subject 160. Complex ores; combination assays; assay of fluxes, of slags and cupels; checks and corrections; tailings assays; sampling and assay of bullion; organization for routine work.

163. Assaying Laboratory.

Courses 2 and 8, IV Year; 3 hrs. laboratory per week, second term.

An advanced laboratory subject in which some of the methods of subject 162 are used.

164. Assaying Laboratory.

Courses 6 and 8a, III Year; 3 hrs. laboratory per week, first six laboratory periods of first term; two lecture periods of 2 hrs. each for the first two Mondays of the session.

An introductory laboratory subject for chemical engineers. Some lecture instruction is given. An abbreviation of subjects 160 and 161.

165. Mining Laboratory. C. G. Williams, S. E. Wolfe.
Courses 2 and 9, I Year; 2 hrs. laboratory per week, first term.
A laboratory subject including some lectures, being an introduction to certain mining and milling machinery and methods.

166. Mining Laboratory. C. G. Williams, S. E. Wolfe.
Courses 2 and 9, IV Year; 3 hrs. laboratory per week, second term.
Special mining problems.

167. Mining. C. G. Williams.
Courses 2 and 9, II Year; 1 hr. lecture per week, first term. An introductory course of lectures.

168. Mining. S. E. Wolfe.
Courses 8, II Year; 1 hr. lecture per week, both terms.
Principles of Mining.

170. Mining. C. G. Williams.
Courses 2 and 9, III Year; 1 hr. lecture per week, both terms.
Principles of mining.

171. Mining. C. G. Williams.
Courses 2 and 9, IV Year; 2 hrs. lectures per week, second term.
Special problems, estimates, reports.

172. Mine Management. C. G. Williams.
Courses 2 and 9, IV Year; 2 hrs. lectures per week, first term.
Consideration of organization, efficiency methods of operation, some of the business aspects of mining and pays particular attention to labour relations.

173. Mine Ventilation and Allied Problems. G. R. Lord.
Course 2, IV Year; 2 hrs. lectures per week, first term.
Ventilation problems in Canadian mines, including the use of ventilation equipment, selection of fans, testing equipment, ventilation studies, the silicosis problem, fire control, etc.

174. Mine Ventilation Laboratory. The Staffs in Mining and Mechanical Engineering.
Course 2, IV Year; 3 hrs. laboratory per week, first term.
Experiments in the laboratories and problems in the study room to give the student some practice in the use of ventilation test equipment, and the solution of ventilation problems.

175. Ore Dressing. C. G. Williams.

Courses 2 and 8, III Year; 2 hrs. lectures per week, second term.

The general principles of ore dressing.

176. Ore Dressing Laboratory. C. G. Williams, S. E. Wolfe.

Courses 2 and 8, III Year; 6 continuous hrs. laboratory per week, second term.

Work with crushing machinery, principles of crushing and grading, screen analyses, concentration with gravity separation apparatus, etc.

177. Ore Dressing. C. G. Williams.

Courses 2 and 8, IV Year; 1 hr. lecture per week, both terms.

Subject 175 continued, study of flow sheets, and special problems.

178. Ore Dressing. C. G. Williams, S. E. Wolfe.

Courses 2 and 8, IV Year; 6 continuous hrs. laboratory per week, first term.

Advanced work with ore dressing appliances, ore testing, and check mill runs.

180. Ore Dressing Laboratory. C. G. Williams, S. E. Wolfe.

Course 8a, IV Year; 3 hrs. laboratory per week, both terms.

Principles of sampling, crushing, and grading, screen analyses, concentration with gravity separation apparatus, flotation, ore testing, etc.

181. Principles of Ore Dressing. S. E. Wolfe.

Courses 2, 8 and 9, III Year; Course 8a, IV Year; 2 hrs. lectures per week, first term.

Ore dressing methods involve a study of the laws governing the phenomena of surface tension, capillarity, and colloidal solutions, in addition to those of hydrostatics and certain phases of hydraulics. This is embodied in a special course of lectures in conjunction with laboratory work in the ore dressing laboratory.

182. Theory of Measurements. S. E. Wolfe.

Courses 2 and 9, II Year; 1 hr. lecture per week, first term.

This title is not an entirely suitable one for this subject because it is generally applied to a study of the philosophy of extremely accurate measurements. The mining engineer has to continually make satisfactory use of measurements with a wide range of inaccuracy. This subject deals with the philosophy underlying the causes of these errors and the practical application of such approximations. The opportunity is taken in these lectures to deal with the subject of illustrating measurements by graphs.

183. Introductory Research. C. G. Williams, S. E. Wolfe.

Course 2, III Year; 3 hrs. laboratory per week, second term.

A laboratory subject consisting of short experimental problems. It is designed to develop the individual student's initiative by his systematic observance of the effects of variables.

184. Summer Letters. C. G. Williams.

Course 2, III Year.

A series of letters written during the summer vacation, dealing with various aspects of a mining engineer's work. These are intended to direct and help the student's powers of observation, analysis, and criticism, as well as being exercises in the art of lucid technical expression.

Special instructions will be issued in connection with these letters.

185. Summer Essays. C. G. Williams.

Course 2, IV Year.

Special instructions will be given in connection with this work.

186. Problems and Seminar. The Staff in Mining Engineering.

Course 2, II, III, and IV Years; Course 9, II Year; 2 hrs. seminar per week, first term.

A seminar in which the students discuss technical and business problems, under their own supervision. A portion of the time is given to guest speakers on special subjects.

ASTRONOMY AND GEODESY

200. Practical Astronomy. J. W. Melson.

Course 1, II Year; 2 hrs. lectures per week, second term.

Practical determination of time, latitude, and azimuth, by methods adapted to the use of the surveyor's transit. The subject will be designed to enable the student to carry out these observations at the Summer Survey Camp.

Reference books: Nautical Almanac, 1947. Printed Lecture Notes—S. R. Crerar.

201. Astronomy and Geodesy. J. W. Melson.

Course 1, III Year; 2 hrs. lectures per week, second term.

Determination of time, latitude, longitude, and azimuth, by methods adapted to the use of the surveyor's transit and the sextant. It is designed to fulfil the requirements of the final examinations for Ontario and Dominion Land Surveyors.

In Geodesy an account is given of the principles and methods of a secondary triangulation survey, also of the principles involved in the North-west system of survey.

Text books: Practical Astronomy as applied to Geodesy and Navigation—Doolittle. Notes on Practical Astronomy and Geodesy. Nautical Almanac.

BOTANY

210. Properties of Living Matter. G. H. Duff.
Course 5r, III Year; 2 hrs. lectures per week, both terms.
Cellular and protoplasmic organization from both the structural and functional points of view.

211. Low Temperature Physiology. G. H. Duff.
Course 5r, IV Year; 1 hr. lecture per week, both terms.
Cryophilic organisms and the physiological and biochemical effects of low temperature.

212. Low Temperature Physiology Laboratory. G. H. Duff.
Course 5r, IV Year; 3 hrs. laboratory per week, both terms.
A laboratory subject supplementing subject 211.

CIVIL ENGINEERING

215. Municipal Engineering. A. E. Berry, P. H. Mills.
Course 1c, IV Year.
a. Municipal Engineering—Sanitary. 1 hr. lecture per week both terms; 5 hrs. laboratory per week, first term; 4 hrs. laboratory per week, second term.
b. Municipal Engineering—Administration. 1 hr. lecture per week, second term.

Problems of water supply, sewerage, and municipal sanitation as viewed by the engineer. This subject includes the design of water distribution and sewer systems, as well as water and sewage treatment works. Municipal government, assessment and taxation, municipal finance, public utilities, expropriation, annexation problems, town planning, local improvement, and other laws relating to municipalities. Problems are assigned, from assumed data and from material secured in the field, to be worked out in the drafting room under subject 301.

216. Transportation Engineering. W. M. Treadgold, W. L. Sagar, R. F. Legget.
Course 1d, IV Year; 2 hrs. lectures per week, both terms; 5 hrs. laboratory per week, first term; 4 hrs. laboratory per week, second term.
Principles governing the location, design, and construction of railways, highways, airports, and inland waterways.

217. Water Power Engineering. R. F. Legget, G. R. Lord.
Course 1e, IV Year; 2 hrs. lectures per week, both terms; 5 hrs. laboratory per week, first term; 4 hrs. laboratory per week, second term (see subject 444).
Principal features of the hydraulic design of water power and water control projects, including hydrological studies, design of pipe lines, surge tanks, and canals; elements of water power machinery and water control equipment, together with the design of water-retaining structures such as earth and concrete dams.

CHEMISTRY AND CHEMICAL ENGINEERING

221. Chemistry. E. A. Smith, W. C. Macdonald, J. G. Breckenridge.

Courses 1, 2, 3, 5, 6, 7, 8, 8a, 9, and 10, I Year; 2 hrs. lectures per week, both terms.

Advanced chemical theory, with industrial and engineering applications.

222. Chemical Laboratory. L. J. Rogers, E. A. Smith, R. R. McLaughlin, D. J. Le Roy.

Courses 1, 3 and 7, I Year; 6 hrs. laboratory per week, one term.

Courses 2, 8 and 9, I Year; 6 hrs. laboratory per week, both terms.

Courses 6 and 8a, I Year; 9 hrs. laboratory per week, one term; 6 hrs. laboratory per week, other term.

Courses 5 and 10, I Year; 3 hrs. laboratory per week, both terms.

Quantitative experiments illustrating the use of the sensitive balance, and confirming the fundamental laws of chemistry; qualitative inorganic analysis; quantitative analysis.

223. Inorganic Chemistry. R. R. McLaughlin.

Courses 6, 8 and 8a, II Year; 1 hr. lecture per week, both terms.

A continuation of subject 221.

224. Chemistry. M. C. Boswell, J. G. Breckenridge.

Courses 2 and 9, II Year; 1 hr. lecture per week, both terms.

Organic—An introductory subject for the purpose of familiarizing the student with some of the principles and general reactions of organic chemistry, as illustrated in special cases arising in chemical industry.

Inorganic—A lecture subject dealing with fundamental chemical principles as applied to the treatment of ores and other mineral products.

225. Analytical Chemistry. L. J. Rogers.

Courses 2, 8 and 9, III Year; 1 hr. lecture per week, both terms.

Principles of chemical analysis: select gravimetric and volumetric methods; technical analysis.

226. Engineering Chemistry. R. R. McLaughlin.

Courses 3 and 7, II Year; 1 hr. lecture per week, both term.

Water-softening, corrosion, petroleum, rubber, and plastics.

227. Analytical Chemistry Laboratory. E. A. Smith.

Courses 2 and 9, II Year; 3 hrs. laboratory per week, second term.

Gravimetric determination of metals and acids, with elementary volumetric analysis, accompanied by lectures.

228. Analytical Chemistry Laboratory. L. J. Rogers.
Course 8, II Year; 9 hrs. laboratory per week, both terms.
Course 8a, II Year; 12 hrs. laboratory per week, first term; 11 hrs. laboratory per week, second term.
Comprising gravimetric and volumetric methods, acidimetry and alkalimetry.
Text books: Analytical Chemistry, Vol. II—Treadwell-Hall. Qualitative Chemical Analysis—A. A. Noyes.

229. Chemical Laboratory. L. J. Rogers, F. E. Beamish, E. A. Smith, R. R. McLaughlin.
Course 6, II Year.
This subject will commence September 3, and will continue until September 21, 1946, the entire working week being spent in the laboratory on quantitative analysis.

230. Industrial Chemistry A. J. W. Bain.
Courses 6, 8a and 11, II Year; 1 hr. lecture per week, both terms.
Manufacture of acids, alkalies, and inorganic chemicals.

231. Industrial Chemistry B. E. A. Smith.
Courses 6 and 8a, II Year; 1 hr. lecture per week, second term.
Water softening, corrosion, explosives.

232. Industrial Chemistry and Technical Analysis. E. A. Smith.
Course 6, II Year; 11 hrs. laboratory per week, first term.
An introductory laboratory subject in industrial chemistry containing experiments on petroleum products, fertilizers, etc., colorimetric determination of hydrogen-ion, and stoichiometric calculations.

233. Engineering Chemistry. J. G. Breckenridge.
Courses 1 and 11, II Year; 1 hr. lecture per week, both terms.
Water-softening, corrosion, explosives, rubber, and plastics.

234. Industrial and Laboratory Synthesis in Organic Chemistry. M. C. Boswell.
Course 6, II Year; 2 hrs. lectures per week, both terms.
A discussion of the chemical reactions used in synthesis in the laboratory and the factory, and of the conditions under which compounds are brought into reaction, the conditions used for securing high yields, and the methods employed for isolating compound from reaction mixtures both in the laboratory and in industry.

235. Industrial and Laboratory Methods of Synthesis. M. C. Boswell, R. R. McLaughlin, J. G. Breckenridge.
Course 6, II Year; 10 hrs. laboratory per week, second term.
A laboratory subject accompanying lecture subject 234.

236. Physical Chemistry. D. J. Le Roy.
Courses 6, 8, and 8a, II Year; Course 9, III Year; 2 hrs. lectures per week, both terms.
Principles of Phase Rule; introduction to chemical thermodynamics and theory of solutions.

237. Analytical Chemistry Laboratory. L. J. Rogers.
Courses 2 and 9, III Year; 6 hrs. laboratory per week, first term; 3 hrs. per week, second term.
Technical analysis of ores and furnace products.

238. Industrial Chemistry and Chemical Engineering.
Industrial Chemistry. E. A. Smith.
Course 6, III Year; $13\frac{1}{2}$ hrs. laboratory per week, second term.
A continuation of subject 232, containing experimental work on coal, petroleum, illuminating gas, sugars, starch, etc., potentiometric determination of hydrogen-ion, and stoichiometric calculations. Instruction in glass blowing is given in this subject.
Chemical Engineering. Staff in Chemical Engineering.
Course 6, III Year; 30 hrs. laboratory.
A subject in Chemical Engineering introductory to subject 251.

239. Advanced Physical Chemistry. A. R. Gordon.
Course 8, III Year; 2 hrs. lectures per week, both terms.
A course for metallurgy students dealing particularly with Chemical Thermodynamics as applied to metallurgical reactions.

240. Chemical Theory. J. W. Bain, R. R. McLaughlin.
Courses 6 and 8a, III Year; 2 hrs. lectures per week, second term
Chemical theory.

241. Industrial Chemistry. E. A. Smith.
Course 6, III Year; 1 hr. lecture per week, both terms.
Petroleum and its products, coal tar and its products, fats, oils, soap, sugar, starch, rubber, fermentation industries, etc.

242. Chemical Engineering. J. W. Bain.
Courses 6 and 8a, III Year; 2 hrs. lectures per week, first term.
The theory and practice of heat transfer, evaporation, filtration, and other industrial operations.
Text book: Elements of Chemical Engineering — Badger and McCabe.

244. Organic Chemistry, Industrial and Laboratory Synthesis. M. C Boswell.
Course 6, III Year; 2 hrs. lectures per week, both terms.
A continuation of subject 234.

245. Industrial and Laboratory Methods of Synthesis in Organic Chemistry. M. C. Boswell, R. R. McLaughlin, J. G. Breckenridge.
Course 6, III Year; $10\frac{1}{2}$ hrs. laboratory per week, first term.
Laboratory and industrial reactions are performed, in some cases using the following small scale industrial apparatus: filter press, sulphonator, tanks for precipitation, electric stirrer, vacuum evaporator, vacuum drier, fusion pot, ball mill, high pressure autoclaves, pumps for transferring liquids, and materials for constructing electric tube furnaces and thermocouples.

Text books: Manual of Industrial Chemistry (Organic)—Rogers. Practical Methods of Organic Chemistry—Gattermann. Unit Processes in Organic Synthesis—Groggins. Die Methoden der Organischen Chemie—Houben-Weyl.

246. Electrochemistry. F. E. W. Wetmore.
Courses 6 and 8, III Year; 16 lectures, first term.
Elementary electrochemistry.

247. Electrochemistry Laboratory. F. E. W. Wetmore.
Course 6, III Year; 18 hrs., first term.
Course 8, III Year; 3 hrs. per week, first term.
Quantitative measurements to accompany subject 246.

248. Chemical Engineering Thermodynamics. J. W. Bain.
Course 6, IV Year; 1 hr. lecture per week, both terms.
Chemical thermodynamics, dealing with problems in chemical engineering.

249. Catalysis in Organic Chemical Industry. M. C. Boswell.
Course 6, IV Year; 1 hr. lecture per week, both terms.
A continuation of subjects 234 and 244, and embracing as well a discussion of the methods used in several of the industries employing catalysts.

250. Organic Chemistry. R. R. McLaughlin.
Courses 5 and 8a, II Year; 1 hr. lecture per week, both terms.
General reactions and methods of synthesis of carbon compounds.
Text book: Chemistry of Organic Compounds—Conant.

251. Chemical Engineering and Industrial Organic Chemistry. Staff in Chemical Engineering.
Course 6, IV Year; 15 hrs. laboratory per week, first term.
Quantitative measurements, employing the following standard apparatus: still, heat interchanger, absorption column, and filter press. The experiments have been selected to furnish experimental data for the confirmation of some of the principles and mathematical expressions discussed in subject 242. The subject also includes experiments in industrial chemistry supplementary to subject 245.

252. Chemical Engineering Problems. J. W. Bain, W. C. Macdonald.
Course 6i, IV Year; 1 hr. laboratory per week, first term; 3 hrs. laboratory per week, second term.
Calculations in connection with various problems in chemical engineering.

253. Chemical Engineering. J. W. Bain, W. C. Macdonald.
Course 6i, IV Year; 1 hr. lecture per week, both terms.
A continuation of subject 242.

254. Research. The senior staff in Chemical Engineering.
Course 6i, IV Year; 5 hrs. laboratory per week, first term; 16 hrs laboratory per week, second term.
In this subject, which occupies about three-quarters of the total time of the year, a research problem is given to each student. This provides experience in searching the primary sources of scientific information and in devising analytical methods and designing apparatus applicable to the new problems. Each student is obliged to write a thesis embodying the results of his search of the original literature and his own experimental work. Thus this subject serves as a preparation for the field of research work; and those students who, by ability, taste, and temperament, are fitted for research pass naturally either into industrial research or into the graduate school of the University to pursue further work in this field.

255. Electrochemistry. J. T. Burt-Gerrans.
Courses 6e and 8, IV Year; 1 hr. lecture per week, both terms.
Advanced theory of solutions and electrolysis, and the application to the practice of electro-deposition and electrolytic refining of metals. The subject also includes lectures on the electric furnace with special consideration of efficiency.
Reference books: Electrometallurgy — Borchers. Principles of Applied Electrochemistry—Allmand and Ellingham. The Electric Furnace — Stansfield. The Electric Furnace — Pring. Physical Chemistry for Colleges—Millard.

256. Electrochemistry Laboratory. J. T. Burt-Gerrans.
Course 6e, IV Year; 10 hrs. laboratory per week, first term; 22 hrs. laboratory per week, second term.
Course 8, IV Year; 3 hrs. laboratory per week, second term.
A laboratory subject accompanying subject 255.
Reference book: Practical Physical Chemistry—Findlay.

257. Silicate Chemistry. J. B. Ferguson.
Courses 8a and 9, IV Year; 2 hrs. lectures per week, first term.
The application of phase rule to the chemistry of refractory materials.

258. Industrial Chemistry. E. A. Smith, T. L. Crossley.

Course 6i, IV Year; 1 hr. lecture per week, first term.

Pulp and paper, and cellulose industries.

259. Chemical Theory. J. W. Bain, J. G. Breckenridge.

Course 6, IV Year; 1 hr. lecture per week, first term; 2 hrs. lectures per week, second term.

A course of lectures on the Phase Rule and atomic structure.

DESCRIPTIVE GEOMETRY, ENGINEERING PROBLEMS AND DRAWING

DESCRIPTIVE GEOMETRY

270. Descriptive Geometry. J R. Cockburn.

All Courses, I Year; 1 hr. lecture per week, both terms.

This subject deals chiefly with the principles of orthographic and oblique projections and the application of such principles to the solutions of problems relating to straight lines and planes.

272. Descriptive Geometry. J. R. Cockburn.

Courses 1, 2, 3, 4, 5, 7, 9, 10, and 11, II Year; 1 hr. lecture per week, both term.

A continuation of the work taken in the First Year, with the following additions: problems relating to curved surfaces, principles of shades, shadows and perspective.

274. Descriptive Geometry. J. R. Cockburn.

Course 1, III Year; 1 hr. lecture per week, first term.

Spherical projections, the principles of mapmaking, and the graphical solution of spherical triangles.

ENGINEERING PROBLEMS AND DRAWING

These subjects consist primarily in the solving of problems by the student at the drafting table under the personal guidance of an instructor. The problems are intended to supplement certain lecture courses. The problems in the First and Second Years deal with the fundamental engineering studies—Mathematics, Applied Mechanics, Descriptive Geometry, the plotting of surveys that have been made by the students in the field, Theory of Mechanism, and Steam Engines, while in the Third and Fourth Years, the problems deal mainly with design. During the hours devoted to mathematical problems, members of the staff in mathematics are present to assist.

275. Engineering Problems and Drawing. A. Wardell.

Course 1, I Year; 14 hrs. per week, first term; 9 hrs. per week, second term.

Drawing and lettering. Plotting of original surveys. Problems in descriptive geometry. Graphical and analytical solutions of problems in applied mechanics. Problems in mathematics (analytical geometry and calculus).

276. Engineering Problems and Drawing. A. Wardell.
Courses 2 and 9, I Year; 6 hrs. per week, first term; 6 hrs. per week, second term.
Similar to subject 275.

277. Engineering Problems and Drawing. A. Wardell.
Course 3, I Year; 8 hrs. per week, first term; 15 hrs. per week, second term.
Similar to subject 275.

278. Engineering Problems and Drawing. A. Wardell.
Course 4, I Year; 3 hrs. per week, both terms.
Elementary drawing and lettering. The solving of a few problems in descriptive geometry, applied mechanics, and mathematics.

279. Engineering Problems and Drawing. A. Wardell.
Courses 5 and 10, I Year; 3 hrs. per week, first term; 6 hrs. per week, second term.
Drawing and lettering. Problems in descriptive geometry. Graphical and analytical solutions of problems in applied mechanics.

280. Engineering Problems and Drawing. A. Wardell.
Course 6, I Year; 4 hrs. per week, first term; 8 hrs. per week, second term.
Elementary drawing and lettering. The solving of a few problems in descriptive geometry, applied mechanics, and mathematics.

281. Engineering Problems and Drawing. A. Wardell.
Course 7, I Year; 11 hrs. per week, first term; 6 hrs. per week, second term.
Similar to subject 275.

282. Engineering Problems and Drawing. A. Wardell.
Course 8, I Year; 8 hrs. per week, first term; 7 hrs. per week, second term.
Similar to subject 275.

283. Engineering Problems and Drawing. A. Wardell.
Course 8a, I Year; 5 hrs. per week, first term; 7 hrs. per week, second term.
Similar to subject 280.

284. Engineering Problems and Drawing. J. J. Spence.
Course 1, II Year; 8 hrs. per week, both terms.
Problems in descriptive geometry—intersection of curved surfaces. Plotting of original surveys. Problems in mechanics of materials—properties of sections, designs of simple members. Problems in mathematics (calculus).

285. Engineering Problems and Drawing. J. J. Spence.

Courses 2 and 9, II Year; 8 hrs. per week, both terms.

Problems in descriptive geometry, mechanics of materials. Flow sheet.

286. Engineering Problems and Drawing. J. J. Spence.

Course 3, II Year; 8 hrs. per week, first term; 12 hrs. per week, second term.

Course 10, II Year; 6 hrs. per week, both terms.

Course 11, II Year; 6 hrs. per week, first term; 8 hrs. per week, second term.

Problems in descriptive geometry—intersection of curved surfaces. Problems in mechanics of materials, theory of mechanism, heat engines, electricity. Problems in mathematics (calculus).

287. Engineering Problems and Drawing. J. J. Spence.

Course 6, II Year; 3 hrs. per week, first term; 6 hrs. per week, second term.

Problems in mechanics of materials, electricity, and mathematics.

288. Engineering Problems and Drawing. J. J. Spence.

Course 7, II Year; 6 hrs. per week, first term; 3 hrs. per week, second term.

Similar to subject 286, but with more problems in mathematics.

289. Engineering Problems and Drawing. J. J. Spence.

Course 8, II Year; 3 hrs. per week, first term; 3 hrs. per week, second term.

Problems in mechanics of materials, electricity, and mathematics.

290. Engineering Problems and Drawing. J. J. Spence.

Course 8a, II Year; 5 hrs. per week, first term; 6 hrs. per week, second term.

Similar to subject 287.

291. Engineering Problems and Drawing. W. B. Dunbar.

Course 1, III Year; 10 hrs. per week, first term; 9 hrs. per week, second term.

Problems in design of steel structures, riveted and welded connections, tension members, beams, columns, highway and railway trusses. Problems in descriptive geometry to illustrate the theory of map making.

292. Engineering Problems and Drawing. W. B. Dunbar.

Course 2, III Year; 3 hrs. per week, first term; 3 hrs. per week, second term.

Problems in design of steel structures, riveted and welded connections, tension members, beams, columns.

293. Structural Design Drawing. W. B. Dunbar.
Course 3, III Year; 3 hrs. per week, both terms.
Similar to subject 292.

296. Engineering Problems and Drawing. W. B. Dunbar.
Course 5r III Year; 3 hrs. per week, second term.

297. Engineering Problems and Drawing. W. B. Dunbar.
Course 8a, III Year; 3 hrs. per week, both terms.

298. Engineering Problems and Drawing, Structural. W. B. Dunbar, P. V. Jermyn.
Course 1, IV Year; 10 hrs. per week average, both terms.
Advanced problems on the design of steel and reinforced concrete structures—floor panels, mill buildings, tanks, reservoirs, towers, truss and arch bridges, foundations, dams, retaining walls, wind bracing. Problems on moment distribution in rigid frames, influence lines, and deflection of trusses.

299. Structural Design Drawing. W. B. Dunbar, P. V. Jermyn.
Courses 3 and 11, IV Year; 3 hrs. per week, first term.
Problems on the determination of stresses in, and the design of mill, building, flume trestles, crane runways, and floor panels for machinery loading.

300. Plant Design. R. J. Montgomery.
Course 8a, IV Year; 3 hrs. per week, second term.
Original design of ceramic plants, driers, kilns, etc.

301. Engineering Problems and Drawing, Sanitary. A. E. Berry, M. W. Huggins.
Course 1c, IV Year; 3 hrs. per week, both terms.
Problems on the design of water distribution and sewer systems as well as water and sewage treatment works.

302. Structural Design Drawing. W. B. Dunbar.
Course 11, III Year; 6 hrs. per week, first term; 3 hrs. per week second term.
Similar to subject 292.

ECONOMICS, BUSINESS ADMINISTRATION, AND LAW

306. Municipal Law. P. H. Mills.
Course 1c, IV Year; 1 hr. lecture per week, first term.
A course of lectures dealing with the particular points of law with which the municipal engineer should be familiar.

307. Accounting and Statistics.
Course 11, III Year; 3 hrs. lectures and 2 hrs. laboratory per week, both terms.
An introduction to the theory and practice of accounting, particularly as applied to corporations, and to the methods of collection, presentation, analysis, and interpretation of statistics as applied to business problems.

308. Applied Economics.

Course 11, III Year; 2 hrs. lectures per week, both terms, 2 hrs. laboratory per week, second term.

The economics of the individual firm; the capital market, the labour market, and typical commodity markets; problems of industrial fluctuation.

309. Business Policy.

Course 11, IV Year; 2 hrs. lectures per week, first term; 3 hrs. lectures per week, second term; 3 hrs. laboratory per week, first term; 4 hrs. laboratory per week, second term.

A discussion of the organization of business enterprises, particularly in the field of manufacturing industry; problems of internal administration; relations with other firms and with governments; use of accounting and statistical data in connection with business problems.

310. Business. R. R. Grant.

Courses 1, 2, 3, 6, 7, 8, 8a and 9, III Year; 1 hr. lecture per week, second term.

Elements of business and the basic organization thereof with an introduction to the principles of control through accounting records. The preparation of simple financial statements and explanations of the purpose of the information shown therein. A brief description of the use of business papers such as invoices, bills of exchange, and others.

311. Economics. V. W. Bladen.

All courses, II Year; 2 hrs. lectures per week, both terms.

An introduction to the study of Economics with special reference to the problems of the Canadian economy.

Text book: An Introduction to Political Economy—Bladen.

312. Commercial Law. F. C. Auld.

Course 4, III Year; 1 hr. lecture per week, both terms.

General Principles of the Law of Contracts, Principal and Agent, Partnership and Limited Companies, with special reference to the Companies Acts. General view of the following:—Negotiable Instruments, Sale of Goods, Bills of Sale and Chattel Mortgages, Suretyship and Guarantee.

Text book: Manual of Canadian Business Law—Falconbridge and Smith.

313. Engineering Economics. C. R. Young.

Courses 1, 2, 3, 7, 8, 9, and 11, IV Year; 1 hr. lecture per week; second term.

Principles by which the economic practicability of a project is judged and the comparison of competing proposals is made. Consideration is given to first cost and annual cost, methods of estimating, fixed charges and operating expenses, financing of engineering projects, valuation and appraisals. Special attention is given to depreciation and the methods of providing for it. Typical numerical problems are discussed and solved.

Text books: Engineering Economics—Fish. Financial Engineering—Goldman. Principles of Engineering Economy—Grant.

314. Engineering Law. P. H. Mills.

Courses 1, 3, 6, 7, and 11, IV Year; 1 hr. lecture per week, first term.

A subject designed to co-ordinate engineering practice and law. In the work that is common to all students taking the subject attention is directed to the duties and liabilities of the engineer, workmen's compensation, patents and inventions, copyrights, trade marks, industrial designs, promotion of companies, organization of companies, arbitration, expert evidence, trade unions, combines, and industrial disputes.

Text book: Engineering Law—Laidlaw and Young.

315. Contracts and Specifications. R. F. Legget.

Courses 1 and 4, IV Year; 1 hr. lecture per week, second term.

Fundamental principles of contract and specification writing. The critical examination of typical specifications and agreements by the class, forms an essential feature of the instruction.

Text book: Engineering Law—Laidlaw and Young.

316. Introduction to Management. R. F. Legget.

Course 1, IV Year; 1 hr. lecture per week, both terms.

Lectures dealing with the fundamental principles upon which management is based. Examples are so selected as to provide an introduction to construction practice. The second half is devoted principally to personnel problems and practices in industry and construction. A selected list of required reading is provided.

317. Plant Management. C. G. Williams.

Course 8, IV Year; 1 hr. lecture per week, second term.

Twelve lectures dealing with some phases of labour, plant organization.

318. Industrial Management. E. A. Allcut.

Courses 3, 6, 7 and 8a, IV Year; 1 hr. lecture per week, both terms.

A study of industrial organization, location, arrangement, construction, and equipment of industrial plants for efficiency and

economy, process routing, scheduling work, reports, methods of superintending, employment, systems of compensating labour, and systems of distributing indirect expenses.

Text book: Principles of Industrial Management—Allcut.

320. Public Speaking. G. A. McMullen, W. C. Macdonald, A. M. Fitzgerald.

Course 11, II Year; 1 hr. lecture per week, second term.
Course 4, III Year; 1 hr. lecture per week, both terms.
Course 6, IV Year; 1 hr. lecture per week, both terms.

Principles of public speaking and the means of expression, accompanied by practical application and training in actual speaking.

322. Engineering and Society. C. R. Young, H. A. Innis, H. L. Shepherd, J. H. Dales.

All courses, I Year; 1 hr. lecture per week, both terms.

A series of lectures on economic history intended to show the dynamic role of science and technology in the development of the modern world, and the slow adaptation of social institutions under the impact of rapid technological change. Some attention will be given to the evolution of the more important branches of engineering and the origin of important existing practices and procedures.

323. Introduction to Political Science. R. MacG. Dawson.

All courses, III Year; 1 hr. lecture per week, both terms.

An introduction to the study of government with special reference to the problems of Canadian government.

324. Modern World History. E. W. McInnis.

All Courses, III Year; 1 hr. lecture per week, both terms.

An outline of the chief trends and developments since the beginning of the 19th Century, with emphasis on Britain, the United States, and the main aspects of international relations.

325. Modern Political and Economic Trends. L. T. Morgan, J. E. Hodgetts.

All courses, IV Year; 1 hr. lecture per week, both terms.

A study of recent economic and political trends with particular reference to developments in the United States under the New Deal, in Italy since 1922, and in Russia since 1919.

326. Philosophy of Science. T. A. Goudge.

Courses 1, 2, 3, 5, 6, 7, 8, 8a, 9, 10, and 11, IV Year; Course 4, V Year; 18 lectures, first term, and part of second term.

Origin and development of scientific method; the range of the sciences; logical principles and the analysis of fundamental concepts; problems of life, mind and society.

327. The Profession of Engineering. C. R. Young, R. F. Legget.
Courses 1, 2, 3, 5, 6, 7, 8, 8a, 9, 10, and 11, IV Year; 6 lectures, second term.
Professional engineering organizations in Canada; engineering societies and services; professional ethics; social implications of engineering; the engineer and conservation.

328. Industrial Management A.
Course 11, III Year; 1 hr. lecture and 2 hrs. laboratory per week, first term; 2 hrs. lectures and 1 hr. laboratory per week, second term.
An introduction to industrial organization and management, dealing particularly with its more technical aspects. Such problems as plant location, layout, arrangement, construction, handling of materials, inspection, design, and report writing are dealt with.
Text book: Principles of Industrial Management—Allcut.

329. Industrial Management B.
Course 11, IV Year; 3 hrs. lecture and 3 hrs. laboratory per week, both terms.
A continuation of subject 328, dealing with such matters as production, planning, time and motion study, costs, budgetary control, and payment of labour. Particular emphasis is placed upon the study of Industrial Relations.

ELECTRICITY

330. Electricity. D. N. Cass-Beggs, R. Scott, J. M. Ham, V. V. Mason, E. Wall.
Courses 1, 2, 3, 5, 6, 7, 8, 8a, 9 and 10, I Year; 2 hrs. lectures per week, both terms.
Principles relating to electric circuits, magnetic circuits, instruments, and apparatus in general, with illustrations from commercial practice. The point of view is quantitative rather than descriptive.
Reference books: Introduction to Electrical Engineering—Mueller. Electrical Engineering—Christie.

331. Alternating Currents. A. R. Zimmer, L. S. Lauchland.
Courses 1, 2, 8 and 9, II Year; 1 hr. lecture per week, both terms.
Fundamental calculations of alternating current circuits and various applications of interest to those who are not making electricity a major subject.

332. Electricity. J. E. Reid.
Courses 3, 5, 6, 8, 8a, and 11, II Year; 2 hrs. lectures per week, first term.
Course 7, II Year; 2 hrs. lectures per week, second term.
General principles and calculation of electrical circuits, particularly as applied to the measurement of resistance, current, potential difference, inductance, capacity, power, and energy. The principles

underlying commercial instruments are considered, together with the methods of calibration.

Reference books: Electrical Measurements—Laws. Electrical Measurements in Theory and Application—Smith. Electrical Measurements and Measuring Instruments—Golding.

333. Electrical Fundamentals. J. E. Reid.

Course 7, II Year; 2 hrs. lectures per week, both terms.

A series of lectures extending the study of the fundamental principles underlying the work of subject 332. Applications considered are of particular interest to electrical engineers.

334. Electrical Measurements Laboratory. J. E. Reid.

Courses 3, 5, 6, 8, 8a, and 11, II Year; 3 hrs. laboratory per week, first term.

Course 7, II Year; 6 hrs. laboratory per week, second term.

The more important methods of measurement of resistance, current, potential difference, inductance, and capacity are used, often under conditions such as occur in practice. The principles of measurement are applied to other problems such as the location of line faults and the measurement of temperature rise by resistance changes. Methods of calibrating commercial instruments are also included.

336. Mathematical Applications in Electrical Engineering. V. G. Smith.

Course 7, III Year; 3 hrs. lectures per week, second term.

These lectures are intended to co-ordinate certain branches of mathematics, such as complex numbers, simple determinants, and elementary differential equations, with their applications to the problems of electrical engineering.

337. Electronics. J. E. Reid.

Courses 5c, 5i, 5s, and 7, III Year; Course 5r, IV Year; 3 hrs. lectures per week, second term.

The behaviour of electrons in electric and magnetic fields and the applications of electronics to electrical engineering.

338. Direct Current Machines. A. R. Zimmer, L. S. Lauchland.

Courses 3 and 11, II Year; Course 10, III Year; 2 hrs. lectures per week, second term.

Courses 3 and 11, II Year; 3 hrs. laboratory per week, second term.

A course on the theory and operation of direct current generators and motors.

Reference books: Electrical Engineering, Vol. I—Dawes. Electrical Circuits and Machinery, Vol. I—Morecroft and Hehre. Elements of Electrical Engineering—Cook.

339. Direct Current Machines. A. R. Zimmer, L. S. Lauchland.

Courses 5 and 7, III Year; 2 hrs. lectures per week, first term.

The theory and operation of direct current machines. Methods of calculating the operating characteristics of generators and motors are presented and illustrated by the use of problems.

Reference books: Electrical Engineering, Vol. I—Dawes. Electrical Circuits and Machinery, Vol. I—Morecroft and Hehre. Principles of D.C. Machines—Langsdorf. Direct Current Machinery—Pender. Electrical Engineering—Christie. Elements of Electrical Engineering—Cook. D.C. Machinery—Kloeffler, Brenneman and Kerchner. Direct Current Machinery—McFarland. Direct Current Machinery—Bull.

340. Alternating Currents. A. R. Zimmer, L. S. Lauchland.

Courses 3, 5r, 10, and 11, III Year; 2 hrs. lectures per week, first term.

Courses 6 and 8a, III Year; 2 hrs. lectures per week, first term.

Measurements in simple single-phase and polyphase circuits. Circuit problems are solved by analytical and graphical methods. The operation of induction and synchronous motors and transformers is discussed briefly.

Reference books: Electrical Engineering, Vol. II—Dawes. Electrical Circuits and Machinery, Vol. II—Morecroft and Hehre. Elements of Electrical Engineering—Cook.

341. Alternating Currents. A. R. Zimmer, L. S. Lauchland.

Courses 5c, 5g, 5i, 5s, and 7, III Year; 2 hrs. lectures per week, both terms.

A first course of lectures on alternating current, covering principles of measurement and leading to the analytical and graphical treatment of the simpler problems relative to alternating-current circuits and machinery.

Reference books: Electricity and Magnetism for Engineers, Part II—Pender. Electrical Engineering—Christie. Electrical Engineering, Vol. II—Dawes. Electrical Circuits and Machinery, Vol. II—Morecroft and Hehre. Alternating Current Circuits—Kerchner and Corcoran. Alternating Current Circuits—Bryant, Correll and Johnson. Alternating Current Electrical Engineering—Maccall. Alternating Current Electrical Engineering—Kemp. Elements of Electrical Engineering—Cook.

342. Electrical Design. R. Scott.

Courses 5c, 5i, 5s and 7, III Year; 2 hrs. lectures per week, first term.

Course 7, III Year; 6 hrs. laboratory per week, first term.

Derivation and application of formulae used in the design of magnets, direct current machines, transformers, and other electrical equipment.

343. Electrical Problems and Seminar. V. G. Smith, A. R. Zimmer.
Course 7, III Year; 3 hrs. per week, both terms.

344. Electrical Laboratory. H. W. Price, A. R. Zimmer, R. G. Anthes.
Courses 5c, 5g, 5i and 5s, III Year; 6 hrs. laboratory per week, both terms.
Course 7, III Year, 6 hrs. laboratory per week, first term; 3 hrs. laboratory per week, second term.
A group of experiments on direct current machines, another group on the fundamentals of alternating current circuits, together with experiments on properties of magnetic materials, and on the fundamentals of electronic devices. Introductory experience in the use of alternating current machinery is afforded.

345. Alternating Current Machinery. L. S. Lauchland.
Courses 3, III Year; Course 11, IV Year; 2 hrs. lectures per week, second term.
Characteristics of alternating current machines and the various methods of control.

346. Electrical Laboratory. H. W. Price, A. R. Zimmer.
Course 3, III Year; 3 hrs. laboratory per week, both terms.
Course 11, III Year; 3 hrs. laboratory per week, first term.
Course 11, IV Year; 3 hrs. laboratory per week, second term.
Experiments on alternating current circuits and machines.

347. Electrical Laboratory. H. W. Price, A. R. Zimmer.
Course 5r, III Year; 3 hrs. laboratory per week, both terms.
A modified subject based on subject 344.

348. Electrical Machinery. H. W. Price.
Courses 2 and 8, III Year; 2 hrs. lectures per week, first term.
Lectures and demonstrations dealing with the operation and characteristics of electrical machinery.

349. Electrical Laboratory. H. W. Price, A. R. Zimmer.
Courses 6 and 8a, III Year; 3 hrs. laboratory per week, first term.
Experiments on direct current generators and motors, and alternating current circuits and machines.

350. Electrical Laboratory. H. W. Price, A. R. Zimmer.
Courses 1, 2, 8 and 9, II Year; 3 hrs. laboratory per week, second term.
Experiments planned to give a general knowledge of the operation of direct current machines, simple alternating current circuits, and alternating current machines.

351. Alternating Current Circuit Analysis. V. G. Smith.

Courses 5c and 7, IV Year; 2 hrs. lectures per week, both terms.

Applications of advanced analytical methods made to a.c. bridges, electrical filters, and other networks. Several general network theorems are obtained. The method of symmetrical components is developed and used to solve problems involving unbalance in three-phase circuits. Complex wave forms of voltage and current and their analysis are considered in detail. Simple transients in a.c. circuits are also studied.

Reference books: Principles of Alternating Currents—Lawrence. Alternating Current Circuits—Weinbach. Alternating Current Bridge Methods—Hague. Symmetrical Components—Wagner and Evans. Alternating Current Circuits—Kerchner and Corcoran.

352. Electrical Transmission of Energy. V. G. Smith.

Courses 5c and 7, IV Year; 2 hrs. lectures per week, first term.

The essential factors involved in the electrical transmission of energy. The distributed inductance and capacity of a three-phase transmission line are found. The behaviour of a long line when the voltages and currents are sinusoidal is examined in detail. Graphical constructions are developed and applied to both short and long lines.

Reference books: Transmission Line Theory—Franklin and Terman. Principles of Transmission in Telephony—Weinbach.

353. Alternating Current Machinery. D. N. Cass-Beggs.

Courses 5r and 7, IV Year; 2 hrs. lectures per week, both terms.

A course of lectures on the theory and performance of alternating current power transformers; synchronous generators, motors, and converters; single and polyphase asynchronous motors.

Reference books: Theory of Alternating Current Machinery—Langsdorf. Principles of Alternating Current Machinery—Lawrence. Alternating Current Machines—Puchstein and Lloyd. Alternating Current Machinery—Bryant and Johnson. Electrical Engineering—Christie.

354. Alternating Current Measurements. J. E. Reid.

Course 7, IV Year; 2 hrs. lectures per week, first term.

A.c. bridges for the measurement of inductance, capacitance, resistance, power factor, frequency, etc. The theory, use, and calibration of instrument transformers are covered. The measurement of power, reactive power, and associated quantities in polyphase circuits is discussed.

355. Electrical Laboratory. H. W. Price, A. R. Zimmer, D. N. Cass-Beggs.

Course 7, IV Year; 6 hrs. laboratory per week, both terms.

Studies of principles and properties of single-phase and polyphase circuits and apparatus. Vector and analytical methods are applied

to the solution of problems related to the characteristics of transformers, alternators, synchronous motors, converters, induction motors, transmission lines, and other alternating current equipment. The principles and properties of electronic equipment used in low frequency and power fields, such as mercury arc rectifiers and thyratrons, are studied.

Reference books: Electrical Engineering—Christie. Experimental Electrical Engineering, Vols. I and II—Karapetoff. Principles of A.C. Machinery—Lawrence. A.C. Machinery—Bryant and Johnson. Principles of Alternating Current Machinery—Langsdorf

356. Electrical Laboratory. H. W. Price, A. R. Zimmer, D. N. Cass-Beggs.

Course 5c, IV Year; 6 hrs. laboratory per week, both terms.

A modified course based on subject 355.

357. Engineering Electronics. D. N. Cass-Beggs.

Course 7, IV Year; 1 hr. lecture per week, first term; 2 hrs. lectures per week, second term.

Electronic devices, such as the thyratron, ignitron and mercury arc rectifier, and their application to engineering problems.

Reference books: Electron Tubes in Industry—Henney. Fundamental Electronics and Vacuum Tubes—Albert. Fundamentals of Engineering Electronics—Dow. Applied Electronics—E. E. Staff, M.I.T.

358. Electrical Design. R. Scott.

Course 7, IV Year; 1 hr. lecture and 3 hrs. laboratory per week, second term.

A continuation of subject 342.

359. Seminar.

Course 7, IV Year; 3 hrs. per week, both terms.

361. Communication. B. deF. Bayly, V. G. Smith, R. G. Anthes.

Courses 5c and 7, IV Year; 2 hrs. lectures per week, both terms.

Courses 5i and 5s, IV Year; 2 hrs. lectures per week, first term.

This subject has been arranged so that the work of the first term includes tubes and circuits for amplification, detection, modulation, etc., while the work of the second term covers fundamental communication networks such as filters, bridges and impedance-matching networks.

Reference books: Communication Engineering—Everitt. Fundamentals of Vacuum tubes—Eastman. Fundamentals of Engineering Electronics—Dow. Communication Networks, Vols. I and II—Guillemin. High Frequency Measurements—Hund.

362. Communication Laboratory. B. deF. Bayly, V. G. Smith, R. G. Anthes.

Courses 5c and 7, IV Year; 3 hrs. laboratory per week, both terms.

Courses 5i, and 5s, IV Year; 3 hrs. laboratory per week, first term.

Principles of measurement and demonstrations of principles described in lecture subject 361.

364. Operational Methods. V. G. Smith.

Courses 5c, 5i and 5s, IV Year; 2 hrs. lectures per week, both terms.

A few examples of earlier operational methods are given. The operators of electric circuits are developed and solutions obtained, in the course of which several useful rules concerning shifting and transfer operations, and differentiation and integration with respect to parameters are found and applied. The Heaviside expansion theorem is developed in a simple manner. The connection between Heaviside's methods and the classical methods of Fourier Integrals and Contour Integration is investigated in some detail. Application is made throughout to engineering problems, chiefly in the field of electric circuit analysis.

Reference books: Electromagnetic Theory—Heaviside. Operational Circuit Analysis—Bush. Electric Circuit Theory and the Operational Calculus—Carson. Heaviside's Operational Calculus—Berg. Fourier Integrals for Practical Applications—Campbell and Foster.

365. Applied Electromagnetic Theory. V. G. Smith.

Courses 5c, 5g and 5s, IV Year; 2 hrs. lectures per week, both terms.

The laws of electromagnetism are reviewed and Maxwell's field equations developed. Plane electromagnetic waves and their reflection and refraction at plane surfaces are studied. Skin effects in cylindrical conductors, both solid and hollow are considered. Transmission of energy by wave guides and co-axial cables is investigated. The laws and formulae of the radiation of energy from vertical antennae are developed. The capacity of cables and transmission lines is computed and comparison made between the exact and approximate formulae. Magnetic fields due to conductors carrying current in the neighbourhood of ferromagnetic bodies are investigated in some of the more simple cases.

Reference books: Electromagnetic Theory—Heaviside. Electromagnetic Theory—Stratton. Electromagnetic Problems in Electrical Engineering—Hague.

366. Aircraft Electricity. J. E. Reid.
Course 10, IV Year; 1 hr. lecture per week, second term.
Types of electrical equipment used in aircraft and airports, and with the principles of aircraft radio equipment such as the radio range, radio compass, radio altimeter, direction finding, etc.

367. A. C. Machinery Laboratory. D. N. Cass-Beggs.
Course 5r, IV Year; 3 hrs. laboratory per week, first term.
A short laboratory course in alternating current electrical machinery.

368. Electronics Laboratory. D. N. Cass-Beggs, J. E. Reid, R. G. Anthes.
Course 5r, IV Year; 3 hrs. laboratory per week, second term.
A short laboratory course in electronics, vacuum tubes, and engineering electronics.

GEOLOGICAL SCIENCES

GEOLOGY

380. Geological Field Work. G. B. Langford, W. W. Moorhouse.
Courses 2 and 9, III Year; one week at the University Survey Camp preceding the opening of the first term.

381. Geology, Pleistocene and Physiographic. A. MacLean.
Courses 2 and 9, IV Year; 1 hr. lecture per week, both terms.
Pleistocene Geology. The formation and distribution of the drift deposits of North America, with brief references to other regions.
Physiography. The surface forms of the earth, and the geological factors that have produced them.
Reference books: Ice Ages, Recent and Ancient, and The Last Million Years—Coleman. Physiography—Salisbury.

382. Geological Excursions. A. MacLean.
Courses 2 and 9, IV Year.
During October weekly trips will be made to points of interest near Toronto.

383. Historical Geology. L. S. Russell.
Course 9, III Year; 2 hrs. lectures per week, both terms.
Principles of sedimentation, divisions of the geological column, and the use of fossils in correlation of formations.
Textbook: Historical Geology—Schuchert and Dunbar.

384. Historical Geology Laboratory. L. S. Russell.
Course 9, III Year; 2 hrs. laboratory per week, both terms.
Study of fossils, sediments, and geological maps and sections. A laboratory course to accompany subject 383.

385. Engineering Geology. A. MacLean.
Courses 1 and 5g, III Year; 1 hr. lecture per week, first term; 2 hrs. lectures per week, second term.
Structural, dynamic and economic geology, with special reference to engineering problems.
Reference books: Engineering Geology—Ries and Watson. Geology and Engineering—Legget.

386. Engineering Geology Laboratory. A. MacLean.
Courses 1 and 5g, III Year; 2 hrs. laboratory per week, second term.
Specimens, maps, and sections to accompany subject 385.

388. General Geology. F. G. Smith.
Courses 2 and 9, II Year; 2 hrs. lectures per week, first term; 1 hr. lecture per week, second term.
Geological principles, designed to introduce the student to the study of geology.
Reference books: Geology—Emmons, Thiel, Stauffer, and Allison. Elementary Geology for Canada—Moore.

389. General Geology. F. G. Smith.
Courses 2 and 9, II Year; 2 hrs. laboratory per week, second term.
Maps and sections; accompanying subject 388.

390. Structural Geology. G. B. Langford.
Courses 2 and 9, III Year; Course 5g, IV Year; 2 hrs. lectures per week, first term.
Structures caused by the deformation of the earth's crust.
Text books: Geologic Structures—Willis. Structural Geology—Nevin.

391. Structural Geology. G. B. Langford.
Course 2, III Year; 3 hrs. laboratory per week, first term.
Course 9, III Year; Course 5g, IV Year; 3 hrs. laboratory per week, both terms.
Work with geological maps of folded and faulted areas, structure sections, and the solution of problems relating to folding and faulting. Laboratory course to accompany subject 390.

392. Precambrian Geology. E. S. Moore.

Courses 2 and 9, IV Year; 2 hrs. lectures per week, first term.

Precambrian formations of Canada—their rocks, distribution, relationships, and economic features. Briefer accounts are given of similar formations in the United States and elsewhere.

Reference books: Publications of the Dominion and Provincial geological surveys. Mineral Deposits of the Canadian Shield—Bruce.

393. Mining Geology. G. B. Langford.

Course 9, IV Year; 2 hrs. lectures per week, first term; 1 hr. lecture per week, second term.

Detailed study of the geology of Canadian and foreign mining camps.

394. Mining Geology. G. B. Langford.

Course 9, IV Year; 3 hrs. laboratory per week, both terms.

A laboratory course to accompany subject 393.

396. Mining Geology. E. S. Moore.

Course 2, IV Year; 2 hrs. lectures per week, second term.

Geological problems associated with mining, typical mining regions in Canada, the United States, and elsewhere discussed from the geological side.

Reference books: Gold Fields of the World—Emmons. Mineral Deposits—Lindgren.

397. Precambrian and Economic Geology Laboratory. W. W. Moorhouse.

Course 9, III Year; 2 hrs. laboratory per week, second term.

Special attention to Precambrian formations and the microscopic features of the rocks and mineral deposits.

398. Economic Geology. E. S. Moore.

Course 9, III Year; Department 5g, IV Year.

(*a*) Ore Deposits: 1 hr. lecture per week, both terms.

Discussion of the origin and classification of ore deposits, the mode of occurrence of the chief ores, and statistics of production. Special attention is given to the metals mined in Canada.

(*b*) Economic Geology of the non-metals: 2 hrs. lectures per week, second term.

The origin and mode of occurrence of the valuable non-metallic substances—coal, oil, building stone, gypsum, cement materials, etc.

Reference books: Economic Geology — Ries. Coal — Moore. Geology of Petroleum and Natural Gas—Lilley. Mineral Resources of Canada—Moore. Introduction to the Study of Ore Deposits—Hatch.

399. Economic Geology. E. S. Moore, F. G. Smith.
Course 2, III Year.
(*a*) Ore Deposits: 1 hr. lecture per week, both terms.
(*b*) Economic Geology of the non-metals: 1 hr. lecture per week, second term.
Similar to subject 398.

400. Economic Geology Laboratory. G. B. Langford.
Course 9, III Year; Course 5g, IV Year; 3 hrs. laboratory per week, both terms.
Ores, geological features of mining areas, interpretation of drill logs, geological maps, and structure sections. Excursions are included.

401. Location of Mineral Deposits. G. B. Langford.
Course 5g, IV Year; 1 hr. lecture per week, second term.
Geological features and principles involved in the application of geophysical methods in the search for mineral deposits, and the interpretation of the structure of the earth's crust.

402. Economic Geology. G. B. Langford.
Course 8a, IV Year; 2 hrs. lectures per week, second term.
The nature, occurrence, and origin of non-metallic deposits, excepting fuels.
Reference book: Industrial Minerals and Rocks—A.I.M.E.

403. Geology of Canada. A. MacLean.
Course 9, IV Year; 2 hrs. lectures per week, first term; 1 hr. lecture per week, second term.
A survey of the physiography, historical geology, major structural features, and mineral deposits of the country.

404. Geology of Canada. A. MacLean.
Course 9, IV Year; 2 hrs. laboratory per week, second term.
Accompanying subject 403.

405. Building Materials; Stones. G. B. Langford.
Course 4, IV Year; 1 hr. per week, first term.
Lectures and laboratory work on decorative and structural stones used in building; their properties, sources, extraction, and preparation for use in buildings.
Reference book: Building Stones and Clay Products—Ries.

HEAT ENGINES

420. Elementary Heat Engines. E. A. Allcut, W. A. Wallace.
Courses 3, 10, and 11, II Year; 2 hrs. lectures per week, second term.

Courses 2, 7, 8 and 9, II Year; 1 hr. lecture per week, first term.

The history and development of heat engines generally, the principles upon which they operate, and brief descriptions of the mechanical and thermal features of the different kinds of heat engines used in practice.

Text book: An Introduction to Heat Engines—Allcut.

421. Theory of Heat Engines. E. A. Allcut.

Courses 3, 5r, 6, 7, 8a, 10, and 11, III Year; 2 hrs. lectures per week, both terms.

The application of the laws of thermodynamics, indicating the best conditions for heat engine operation and the maximum possible efficiency, as exemplified by the Carnot and regenerative cycles. The properties of working fluids are studied, and the effect of departures from the perfect cycle is illustrated by the Joule, Otto, Diesel, and Rankine cycles. The uses of entropy diagrams and refrigeration cycles are also considered.

422. Heat Engineering. R. C. Wiren.

Course 3, III Year; 1 hr. lecture per week, both terms.

Internal combustion engines. Types and operation; performance and testing; basic characteristics and principles of design; carburetion; fuel injection; governing.

Steam Turbines. Types and basic characteristics; condensers; cooling towers.

Course 3, III Year; 1 hr. lecture per week, first term.

Steam generators and plant. Combustion calculations; analysis of fuels and products of combustion; boiler tests and heat balance; principles of design and commercial types of boilers, furnaces, stokers, pulverized fuel equipment, economizers, air heaters, superheaters, etc.

Text book: Heat Engines—Allen and Bursley.

Course 3, III Year; 1 hr. lecture per week, second term.

Air conditioning. Air and water vapour mixtures; requirements for comfort and industrial processes; the use of psychrometric charts; heat transmission calculations; heating, cooling, humidifying, and dehumidifying processes; calculation of air conditioning loads; air conditioning systems and equipment.

Text book: Air Conditioning—Holmes.

423. Heat Engine Laboratory. R. C. Wiren, W. Bruce.

Courses 3, 5r, and 10, III Year; 1 three-hr. laboratory period per week, both terms.

Course 7, III Year; 1 three-hr. laboratory period per week, first, term.

Course 11, III Year; 1 three-hr. laboratory period per week, second term.

Mechanical Experiments. I. W. Smith.
Included in above.
Heat Transfer Experiments. F. G. Ewens.
Included in above.

A laboratory subject designed to assist in a clearer understanding of thermodynamics, machine design, and mechanics of machinery. The work on heat engines includes the setting of slide valves, indicating engines, measuring the brake horse-power, and testing of air compressors, blowers, steam engines and internal combustion engines under various conditions.

The mechanical laboratory work deals with testing of belts and lubricating oils, and experiments on balancing of rotating masses. The heat transfer laboratory work deals with testing of insulation, heat exchangers and air conditioning equipment.

424. Heat Power Engineering. R. C. Wiren.
Courses 3 and 5r, IV Year; 2 hrs. lectures per week, first term; 1 hr. lecture per week, second term.

A continuation of lecture course 421. Properties of working substances; transitional stages from liquid to vapour to gas; calculations involving variable specific heats; insulation and heat transfer; refrigeration; power plant cycles including reciprocating engines and turbines; cycles for high pressures and temperatures; superheating, reheating, regeneration, and binary-fluid cycles; steam generators employing forced circulation, indirect evaporation and pressure combustion; power plant heat balance and efficiencies; steam turbines.

425. Internal Combustion and Aircraft Engines. E. A. Allcut.
Courses 3, 5r and 10, IV Year; 1 hr. lecture per week, both terms.

The difference between the efficiencies theoretically attainable and those actually achieved in internal combustion engines is examined in detail. The properties of the fuels used in gasoline and Diesel engines, the methods of testing them, and the various heat losses are described. Some consideration is also given to supercharging, detonation, cooling, and similar practical problems.

426. Heat Engine Laboratory. R. C. Wiren, W. Bruce.
Courses 3 and 5r, IV Year; average $5\frac{1}{2}$ hrs. laboratory work per week, both terms.
Heat Transfer Experiments. F. G. Ewens.
Included in above.
Mechanical Experiments. I. W. Smith.
Included in above.

A continuation and extension of the work covered in the III Year laboratory subject. Complete tests are made of heaters and of engines of various types such as simple, compound and uniflow

steam engines, steam turbines, refrigerating machines, injectors, gas, Diesel and gasoline is made of the thermal cycles involved. A complete set of experiments is made in each case and the results plotted to show clearly to the student the effect of various alterations in adjustment on the results obtained. A complete boiler test is performed and all calculations are made for a heat balance. Experiments are performed on balancing of rotating masses.

427. Theory of Heat Engines. R. C. Wiren.

Courses 1 and 8, III Year; Course 2, IV Year ; 1 hr. lecture per week, both terms.

Thermodynamics of gases and vapours as applied to heat engine cycles and exemplified by internal combustion engines, air compressors, steam engines and turbines, and refrigerating plants.

428. Heat Engine Laboratory. R. C. Wiren, W. Bruce.

Course 1, III Year; eight 3-hr. laboratory periods, second term.

Course 6, III Year; average 1½ hrs. laboratory per week, second term.

Course 8, III Year; 1½ hrs. laboratory per week, second term.

Course 8a, III Year; 1½ hrs. laboratory per week, second term.

Course 2, IV Year; 1½ hrs. laboratory per week, first term.

Experiments with steam and internal combustion engines, compressed air, etc.

429. Heat Transfer and Refrigeration. E. A. Allcut.

Course 5r, IV Year; 2 hrs. lectures per week, both terms.

Refrigeration cycles and properties of refrigerants; flow of fluids and heat transfer; heat insulation; refrigerating machines and controls; air conditioning; cold storage; ice manufacture; industrial applications of refrigeration.

430. Heat Engine Practice. W. Bruce.

Course 8, III Year; 1 hr. lecture per week, both terms.

Heat engine practice as exemplified by steam and internal combustion engines and turbines, air compressors, etc.

HYDRAULICS AND HYDROSTATICS

440. Hydraulics. G. R. Lord, L. E. Jones.

Courses 1, 3, 6, 7, and 11, III Year; 2 hrs. lectures per week, both terms.

Course 2, III Year; Course 8a, IV Year; 2 hrs. lectures per week, first term.

Attention is given to the development and discussion of formulæ relating to the flow of water in pipes, the measurement of discharge by various methods, such as orifices and weirs, the conditions of

flow obtaining in open channels, artificial and natural, and in pipes flowing partially full, together with other kindred subjects.

The object of this subject is to provide the student with a good working knowledge of the fundamental principles of hydraulics, such as are useful in practical work and are necessary to the intelligent investigation of more advanced problems, and such as the design of water supply, sewerage and irrigation systems, and water power plants.

441. Hydraulic Laboratory. G. R. Lord, L. E. Jones, D. G. Huber.

Courses 1, 3, 7, and 11, III Year; one 3 hr. laboratory period per week, second term.

Courses 2 and 6, III Year; six 3 hr. laboratory periods, first term.

Course 8a, IV Year; one 3 hr. laboratory period per week, first term.

The work in this subject is intended to illustrate the lecture subjects given in hydraulics and to give the student some working acquaintance with the formulæ derived. Experiments are made to determine the coefficients for orifices of the various types used in practice and for weirs. The results of these experiments are used in measuring the discharge in subsequent experiments on meters and for the determination of hydraulic resistances in various cases of flow in pipes. The complete subject illustrates very fully the application of the lectures to actual cases.

442. Hydraulics. G. R. Lord.

Course 3, IV Year; 1 hr. lecture per week, both terms.

The various problems of unsteady flow such as occur in power plants, penstocks, etc. Much of the work is done by the process of arithmetic integration, and the lecture work is supplemented by problems solved by the students in the work rooms, the time for which is included in subject 444. Surges, water hammer, stream flow data, etc., are discussed.

The problems of collection of water for power purposes, use of the mass curve, rainfall and evaporation, etc., are also treated as far as possible. The flow of gases and vapours are also discussed.

443. Hydraulics. G. R. Lord.

Course 3, IV Year; 1 hr. lecture per week, first term; 2 hrs. lectures per week, second term.

Theory and design of turbines, pumps, fans, propellers, and other hydraulic machinery, as well as the application of hydraulic systems to aircraft and machine tools. The selection of turbines, pumps, and fans is dealt with, as well as problems related to the mechanical parts of hydraulic power plants. Cavitation in connection with pumps, turbines, and propellers is fully discussed.

444. Hydraulic Laboratory. G. R. Lord, L. E. Jones, D. G. Huber.

Courses 1e and 3, IV Year; average of 5½ hrs. laboratory per week in 3 and 2 hr. periods, both terms.

Experimental work on turbines of various types, and centrifugal and turbine pumps and other similar devices. This experimental work is arranged to illustrate the lectures on turbine and pump design. The experiments are made on hydraulic models and on two large turbine pumps used in the laboratory supply, as well as on apparatus specially designed for instruction. Various methods of measuring water-power and the efficiency of machines are also given. A list of the equipment now available and which is used in this subject, is given in Section XII.

445. Hydraulics. G. R. Lord.

Course 1, IV Year; 1 hr. lecture per week, both terms.

General hydraulic problems such as surges in pipe lines, water hammer, flow in open channels and backwater, mass curves and a general discussion of pumps.

446. Hydraulic Laboratory. G. R. Lord, L. E. Jones, D. G. Huber.

Course 1, IV Year; one 3 hr. laboratory period per week, first term.

Supplementing subject 445.

Experiments are carried out on turbines and pumps, current meter and Pitot tube rating, etc. Problems are worked out in the class room and mass curves, etc., as plotted.

447. Elementary Hydraulics. L. E. Jones.

Courses 1, 3, 6, 7, 8, 8a and 11, II Year; 1 hr. lecture per week, first term.

Fluid properties. Theorems of fluid statics. Pressure-density-height relationships. Measurement of pressure intensity. Fluid thrust on submerged surfaces. Buoyancy and flotation.

448. Mechanical and Thermal Measurements. G. R. Lord, D. G. Huber, W. L. Govan, A. S. Foreman.

Courses 2, 3, 6, 7, 8, 8a, and 9, I Year; 2 hrs. lectures per week, second term.

A subject to prepare the student for work in hydraulics, thermodynamics, machine design, and analogous subjects.

449. Treatment of Technical Data. L. E. Jones.

Course 3, II Year; 2 hrs. lectures per week, first term.

Elementary theory of measurement. Devices and methods for simplifying engineering computations. Uses of various graphs, diagrams, and charts. Elements of curve-fitting and statistical treatment of experimental data.

451. Hydraulics. G. R. Lord.

Course 2, IV Year; 1 hr. lecture per week, second term.

Pumping and drainage problems connected with the operation of mines and mining properties.

452. Aircraft Hydraulics. W. L. Govan.

Course 10, IV Year; 1 hr. lecture per week, first term.

A discussion of the numerous aircraft services that require remotely controlled power operation which can best be performed hydraulically. The basic principles underlying the design of aircraft hydraulic systems are considered in order that the student may understand present systems and master sufficient of the fundamental theory to enable him to follow future design.

Text book: Aircraft Hydraulics—Adams.

MACHINERY

461. Mechanical Engineering. W. G. McIntosh.

Course 3, II Year; 2 hrs. lectures per week, second term.

Materials of design and production methods. In addition, standards, tolerances, limits, fits, and mechanical drafting room practice will be explained.

Text books: Drawings and Drafting Room Practice. A.S.A. Manufacturing Processes—Begeman.

462. Elementary Machine Design. W. G. McIntosh, W. L. Govan.

Courses 6, 7, 8 and 8a, II Year; 2 hrs. lectures per week, second term.

A preparatory subject intended to familiarize the student with the different shop methods and processes, casting, forging, machining, etc., used in the production of machine parts, to enable him to make proper provision in the design of such parts to facilitate their production.

In addition, the various standards, machine and pipe threads, tapers, pipe fittings, etc., are described and mechanical drafting room practice explained. Tolerances, limits, fits and gauges are discussed.

Text book: Factory Equipment—Roe and Lytle. Drawings and Drafting Room Practice. A.S.A.

463. Machinery. W. L. Govan.

Course 1, III Year; 2 hrs. lectures per week, first term.

Design and selection of various machine elements, with particular reference to their application to bridges, shovels and other machinery affecting civil engineers.

Text book: Design of Machine Elements—Faires.

464. Machine Design Laboratory. W. G. McIntosh, I. W. Smith, R. T. Waines, W. L. Govan.

Course 1, III Year; 3 hrs. laboratory per week, first term.

The work in the laboratory and the drafting problems assigned will illustrate the lecture subject.

465. Theory of Machines A. I. W. Smith.

Courses 3 and 10, II Year; 2 hrs. lectures per week, both terms.

A study of basic machine components, including the standard linkages, cams, gearing, and gear trains, with reference to practical applications. Methods for analysis of velocity, acceleration, and force distribution in machines. Effects of friction and determination of efficiency. The plotting and use of crank effort and torque diagrams.

Reference books: Theory of Machines—Angus. Mechanism—Prageman. Mechanism and Kinematics of Machines—Steeds.

466. Theory of Machines B. I. W. Smith.

Course 3, III Year; 2 hrs. lectures per week, first term.

A consideration of inertia forces and their effect in machines. Fluctuation of machine speed and its control by flywheels and governors. Balancing of rotating parts, engine balance, elementary vibration.

A working knowledge of velocity, acceleration, and force analysis is essential in this course.

Reference books: Theory of Machines—Angus. Theory of Machines—Bevan. Mechanics of Machinery—Ham and Crane.

467. Machine Design. W. G. McIntosh.

Courses 3, 10, and 11, III Year; 2 hrs. lectures per week, both terms.

The design of various machine elements, including screw threads for fastening and power transmission, shafting, bearings (journal, thrust, ball, and roller) belts, pulleys, spur gears, flywheels, keys, clutches, etc.

Text book: Design of Machine Elements—Faires.

468. Machine Design and Mechanics of Machinery Laboratory. W. G. McIntosh, I. W. Smith, R. T. Waines, W. L. Govan.

Course 3, III Year; an average of 7½ hrs. laboratory per week, both terms.

Course 7, III Year; 3 hrs. laboratory per week, second term.

Course 10, III Year; 6 hrs. laboratory per week, both terms.

Course 11, III Year; 3 hrs. laboratory per week, both terms.

The work in the laboratory will consist of analytical and graphical solution of problems illustrating the principles involved in the lecture course in Mechanics of Machinery, and the design of

machine parts covered in the lecture course in Machine Design. The object of the work on the drafting board is with a view to developing the students' judgment and sense of proportions in design and the application of drafting room standards.

469. Machine Design. R. T. Waines.

Courses 2, 6, 8 and 8a, IV Year; 1 hr. lecture per week, both terms.

The design of various machine elements, particularly those likely to be met with in chemical and metallurgical plants, and in mining work.

Text book: Design of Machine Elements—Faires.

470. Machine Design Laboratory. W. G. McIntosh, I. W. Smith, R. T. Waines, W. L. Govan.

Courses 2, 6, 8 and 8a, IV Year; 3 hrs. laboratory per week, second term.

Problems worked out in the laboratory, designed to give the student training in the general lay-out of shafting and plant machinery, as well as in the design of simple parts for chemical and metallurgical apparatus, and mine machinery.

471. Machine Design. W. G. McIntosh.

Course 5, II Year; 1 hr. lecture per week, both terms.

Some acquaintance with the selection of materials and their use in the design and construction of machinery. Machine parts are analysed as to suitable materials, production methods, and the nature and magnitude of the stresses encountered.

Text book: Design of Machine Elements—Faires.

472. Machine Design Laboratory. W. G. McIntosh, I. W. Smith, R. T. Waines, W. L. Govan.

Course 5, II Year; 3 hrs. laboratory per week, both terms.

The work in the laboratory will consist of the analytical solution of problems, illustrating the principles involved in the lecture course, and the standard practice in making assembly and detail machine drawings.

473. Machine Design. W. G. McIntosh.

Course 3, IV Year; 2 hrs. lectures per week, both terms.

Design of machine frames, hooks, hoisting equipment, crank shafts, gears of various kinds (helical, herringbone, bevel, screw, worm), springs, clutches, brakes, thin and thick wall vessels. An introduction will be given to the study of dynamic problems connected with the motor car, Diesel engine, and other high speed machinery.

Text book: Design of Machine Elements—Faires.

474. Advanced Machine Design Laboratory. W. G. McIntosh, I. W. Smith, R. T. Waines, W. L. Govan.

Course 3, IV Year; 5 hrs. laboratory per week, first term; 6 hrs. laboratory per week, second term.

Work in the laboratory devoted to the design of complete machines, with the object of giving the student practice not only in the design of various details, but also in working the various elements into a machine of smooth and harmonious design. The machines chosen as examples for design involve as many new machine elements as possible, in order to broaden the training of the student.

The work in the laboratory also involves special shafting problems, including graphical solutions, critical speeds, and multiple supports.

475. Machine Design. I. W. Smith.

Course 7, III Year; 2 hrs. lectures per week, both terms.

Principles of stress analysis and the design of various machine elements, including screw threads, shafting, bearings, belts, gears, flywheels, etc.; also an introduction to work on speed fluctuation and balancing.

Text book: Design of Machine Elements—Faires.

476. Manufacturing Processes.

Courses 11, IV Year; 2 hrs. lectures per week, both terms.

A study of metal casting, mechanical working, welding, heat treating, plastics and ply-wood moulding, finishes, machining, and mass production engineering.

477. Manufacturing Processes Laboratory.

Course 11, IV Year; 3 hrs. laboratory per week, both terms.

Design of castings and forgings and the selection of suitable manufacturing processes from raw material through forming, machining, mass production tooling, gauging, and finishing.

MATHEMATICS

490. Calculus. S. Beatty, I. R. Pounder, J. D. Burk, B. A. Griffith.

Courses 1, 2, 3, 4, 6, 7, 8, 8a and 9, I Year; 2 hrs. lectures per week, both terms.

Course 7, I Year, one 3 hr. period per week, both terms, for problems.

Derivation of the fundamental formulæ of the differential and integral calculus, with early applications to simple problems concerning graphs, areas, volumes, lengths, centres of gravity, and moments of inertia. Problems are dealt with in the drafting room as outlined in subjects 275, 276, 277, 278, 279, 280, 281, 282, and 283. For Course 7, an additional period of three hrs. per week is provided for problems and exercises, conducted by the Department of Mathematics.

491. Calculus. A. F. C. Stevenson, D. C. Baillie, A. Schild, B. White.

Courses 1, 3, 6, 7, 8, and 11, II Year; 2 hrs. lectures per week, both terms.

Course 7, II Year; one 3 hr. period per week, both terms, for problems.

Continuation of subject 490. The elementary theory reviewed and extended. Special attention to applications with problems in engineering mostly in view. Introduction to the study of simple differential equations. Problems are dealt with in the drafting room as outlined in subjects 284, 285, 286, 287, 288, and 289. For Course 7, an additional period of three hrs. per week is provided for problems and exercises, conducted by the Department of Mathematics.

492. Analytical Geometry. S. Beatty, I. R. Pounder, J. D. Burk, B. A. Griffith.

Courses 1, 2, 3, 4, 6, 7, 8, 8a and 9, I Year; 1 hr. lecture per week, first term, 2 hrs. per week, second term.

The work in Elementary Analytical Geometry covers the more familiar propositions in connection with the straight line, circle, parabola, ellipse, and hyperbola. The subject is treated to illustrate the general methods of analytical geometry. In addition problems are dealt with in the drafting room as outlined in subjects 275, 276, 277, 278, 279, 280, 281, 282, and 283. A part of the problem time for Course 7 listed under subject 490 is devoted to problems in analytical geometry.

493. Spherical Trigonometry. J. W. Melson.

Course 1, II Year; 1 hr. lecture per week, first term.

The derivation of formulæ and their application to the solution of triangles and to practical problems.

Text books: Spherical Trigonometry—Todhunter and Leatham Printed Lecture Notes—J. W. Melson.

494. Least Squares. J. W. Melson.

Course 1, II Year; 1 hr. lecture per week, second term.

The general principles of probability, the law of error, direct measurements of equal and different weights; mean square and probable errors; indirect measurements; conditioned observations; applications to empirical constants and formulæ, etc.

Text books. Least Squares—Merriman. Printed Lecture Notes —J. W. Melson.

502. Algebra and Calculus. G. de B. Robinson.

Courses 5 and 10, I Year; $3\frac{1}{2}$ hrs. lectures per week, both terms.

Polynomials and rational functions, elementary theory of equations, inequalities, determinants, limits, summation of series,

binomial, exponential, and logarithmic series, expansions of the circular and hyperbolic functions and their inverses, the methods and operations of the Calculus considered intuitively and illustrated by applications, and elementary differential equations.

Text books. Introduction to the Calculus—Osgood. Introduction to the Calculus—Beatty and Jenkins.

503. Analytical Geometry of the Plane. G. de B. Robinson.

Courses 5 and 10, I Year; $1\frac{1}{2}$ hrs. lectures per week, both terms.

Cartesian and polar coordinates, transformation of coordinates, straight lines and curves of the second degree, projective properties of conics, the principle of duality, higher plane curves.

Text book: Analytical Geometry—Nowlan.

504. Differential Calculus. D. A. F. Robinson.

Courses 5 and 10, II Year; 3 hrs. lectures per week, both terms.

Differentiation, Taylor's theorem and series for functions of one or more variables, families of curves and surfaces and their differential equations, Jacobians, geometrical and mechanical applications.

Text books: Introduction to the Calculus—Osgood. Introduction to the Calculus—Beatty and Jenkins.

505. Integral Calculus and Differential Equations. W. J. Webber.

Courses 5 and 10, II Year; 3 hrs. lectures per week, both terms.

The indefinite integral, integration of rational and other special functions, the definite integral, differentiation with respect to a parameter, multiple integration, Fourier's series, geometrical and mechanical applications, approximate integration, introduction to ordinary differential equations.

Text books: Introduction to the Calculus—Osgood. Intreduction to the Calculus—Beatty and Jenkins.

506. Analytical Geometry of Space. J. A. Jenkins.

Courses 5 and 10, II Year; 1 hr. lecture per week, both terms.

Cartesian and other systems of point coordinates, curves and surfaces and their equations in parametric or non-parametric form, data fixing planes, lines, conics, and quadrics, generating lines and circular spectrons of quadrics, classification of quadrics, tangent cones to quadrics, metric and projective properties of quadrics, families of quadrics, ruled surfaces and surfaces of revolution.

Text book: Coordinate Geometry—Eisenhart.

507. Differential Equations. Miss C. C. Krieger.

Course 1, III Year; 1 hr. lecture and 1 hr. problem work per week, both terms.

First order equations, solvable by quadratures, linear equations

of first and second order, linear equations with constant coefficients of higher order, solution in series, Fourier's series.

Text books: Elementary Differential Equations—Kells. Differential Equations—Reddick.

508. Theory of Functions. Miss C. C. Krieger.

Courses 5 and 10, III Year; 1 hr. lecture and 1 hr. problem work per week, both terms.

Complex numbers, limits and series, analytic functions, Cauchy's theorem, Taylor and Laurent series, singularities and their significance, analytic continuation, contour integration, conformal mapping of one plane region on another.

Text books: Functions of a Complex Variable—Phillips. Theory of Functions—Copson. Theory of Functions as applied to Engineering Problems—Rothe, Ollendorff, and Pohlhausen.

509. Differential Equations. Miss C. C. Krieger.

Courses 5 and 10, III Year; 1 hr. lecture and 1 hr. problem work per week, both terms.

First order equations solvable by quadratures, depression of the order, the linear equation, the linear equation with constant coefficients, and operator methods, the linear partial differential equation, particular equations of the second order.

Text books: Differential Equations—Piaggio. Intermediate Differential Equations—Rainville. Fourier Series and Boundary Value Problems—Churchill.

MATHEMATICS, APPLIED

520. Theoretical Mechanics. A. Weinstein.

Course 5, III Year; 1 hr. lecture and 1 hr. problem work per week, both terms.

A systematic application of mathematical methods to the solution of problems in mechanics, with emphasis on general principles. The problems deal chiefly with the plane motion of particles and rigid bodies. Lagrange's equations are introduced.

Text book: Principles of Mechanics—Synge and Griffith.

521. Differential Equations of Mathematical Physics. A. F. Stevenson.

Courses 5 and 10, IV Year; 2 hrs. lectures per week, both terms.

The underlying theory and important particular equations, including eigenvalues and eigenfunctions, Fourier series, spherical and cylindrical harmonics, vibration of strings, membranes, and rods, sound waves, water waves, equation of heat conduction.

522. Theory of Elasticity. A. Weinstein.

Course 10, IV Year; 2 hrs. lectures per week, first term.

General analysis of strain and stress, stress-strain relations, equations of equilibrium, bending of beams, shell and pipe with internal pressure, torsion problems.

523. Theoretical Hydrodynamics. B. A. Griffiths.

Course 10, IV Year; 1 hr. lecture per week, both terms.

The fundamental theory of hydrodynamics with special reference to aerodynamics, including irrotational motion, aerofoil theory, boundary layer theory.

Text book: Aerofoil and Airscrew Theory—Glauert.

METALLURGY

530. Metallurgy. L. M. Pidgeon.

Course 8, II Year; Courses 2 and 9, III Year; 1 hr. lecture per week, first term.

An introductory course describing the theory and practice of metallurgical operations.

531. Fuels and Combustion, J. E. Toomer.

Courses 8 and 8a, II Year; 1 hr. lecture per week, both terms.

Fuels, their use, preparation, calorific value, and combustion.

533. Physical Metallurgy. J. A. Newcombe.

Course 11, II Year; Courses 3, 5, 7, and 8a, III Year; 2 hrs. lectures per week, second term.

General physical metallurgy, including the common engineering alloys.

534. Metallurgy. L. M. Pidgeon.

Course 8, III Year; 2 hrs. lectures per week, first term; 1 hr. lecture per week, second term.

A general discussion of the fundamental principles of metallurgy, including the production of the more important metals. Metallurgical problems are included in this course.

535. Metallurgy Laboratory. J. E. Toomer.

Course 8, III Year; 6 hrs. continuous laboratory per week, both terms.

Experiments in roasting, smelting, leaching, and retorting.

536. Physical Metallurgy. J. A. Newcombe.

Course 8, III Year; 2 hrs. lectures per week, both terms.

The physical metallurgy of the common alloys; equilibrium diagrams. Pyrometry.

537. Metallography Laboratory. J. A. Newcombe.

Course 8, III Year; 3 hrs. laboratory per week, both terms.

The use of the microscope. The preparation of alloys. Pyrometry.

538. Metallurgy. L. M. Pidgeon.
Course 2, IV Year; 1 hr. lecture per week, both terms.
Calculations necessary to understand metallurgical processes.

539. Metallurgy Laboratory. J. E. Toomer.
Course 2, IV Year; 6 hrs. continuous laboratory per week for one half of second term.
Similar to subject 535.

540. Metallurgy Problems. L. M. Pidgeon.
Course 8, IV Year; 2 hrs. lectures per week, both terms.
Problems of chemical reactions, thermochemistry, electrolysis, vapor pressure, transmission of heat, etc.

541. Metallurgy Laboratory. J. E. Toomer.
Course 8, IV Year; 6 hrs. continuous laboratory per week, first term; 2 hrs. laboratory per week, second term.
Metallurgical analyses of ores, furnace products, and alloys.

542. Metallurgy. L. M. Pidgeon.
Course 8, IV Year; 1 hr. lecture per week, both terms.
Critical reading and discussion of papers, describing metallurgical processes or dealing with plant arrangement and construction.

543. Physical Metallurgy. J. A. Newcombe.
Courses 6m and 8, IV Year; 2 hrs. lectures per week, both terms.
A continuation of subject 536, dealing more particularly with the ferrous alloys. Part of the lectures consist of discussions of photo-micrographs.

544. Metallography Laboratory. J. A. Newcombe.
Course 8, IV Year; 3 hrs. laboratory per week, both terms.
Specimens of the common alloys are prepared, microscopically examined, and photographed.

545. Physical Metallurgy. J. A. Newcombe, W. L. Sagar.
Course 8, IV Year; 3 hrs. laboratory per week, first term.
The introductory part of this subject is intended to give some familiarity with the experimental study of the elastic and physical properties of iron and steel, and in the use of testing machines and instruments of precision designed for that purpose. Following this, carbon and alloy steels are given different heat treatments. The structures developed are examined and photographed, mechanical tests are made and findings correlated.

546. Physical Metallurgy. J. A. Newcombe.
Courses 1, 2, 6, and 9, III Year; 1 hr. lecture per week, second term.
The mechanical properties and heat treatment of steel; cast-iron.

547. Heat Treatment of Iron and Steel. J. A. Newcombe.
Courses 3 and 11, IV Year; 1 hr. lecture per week, both terms.
The principles underlying the heat treatment and mechanical treatment of carbon and alloy steels. Cast iron.

548. Heat Treatment of Iron and Steel Laboratory. J. A. Newcombe.
Courses 3 and 11, IV Year; 1½ hrs. laboratory per week, second term.
Preparation of specimens of steels and irons, and examining them microscopically.

549. Physical Metallurgy Laboratory. J. A. Newcombe.
Courses 2 and 9, III Year; 1 hr. laboratory per week, second term.
Specimens of the common alloys are prepared and microscopical examined.

550. Metallurgical Theory. J. W. Bain.
Course 8, IV Year; 1 hr. lecture per week, both terms.
A study of equilibria at high temperatures in production metallurgy.

551. Aircraft Materials. J. A. Newcombe, L. M. Pidgeon.
Course 10, IV Year; 1 hr. lecture per week, both terms.
Alloys of magnesium and aluminum, high strength steels, castings and forgings, together with wood and plastics, as used in aircraft construction.

CERAMICS AND NON-METALLIC MINERALS

560. Non-Metallic Minerals. R. J. Montgomery.
Course 8a, III Year; 4 hrs. lectures per week, first term; 2 hrs. lectures per week, second term.
Industrial classification, properties, and utilization of non-metallic minerals. Ceramic plant practice is covered in some detail in the second term.

561. Non-Metallic Minerals Laboratory. R. J. Montgomery.
Course 8a, III Year; 7 hrs. laboratory per week, first term; 8½ hrs. laboratory per week, second term.
The physical properties and thermal characteristics of non-metallic minerals are studied from an industrial standpoint.

562. Ceramics. R. J. Montgomery.
Course 8a, III Year; 2 hrs. lectures per week, second term.
The composition of clear and coloured glazes.

563. Ceramic Calculations. J. E. Toomer.
Course 8a, IV Year; 1 hr. lecture per week, first term.
Lectures and problems on calculations necessary for the compounding of ceramic bodies and glazes.

564. Ceramics Laboratory. J. E. Toomer.
Course 8a, III Year; $10\frac{1}{2}$ hrs. laboratory per week, first term; 3 hrs. laboratory per week, second term.
Practice in the analysis of non-metallic minerals.

565. Refractories and Ceramic Bodies. R. J. Montgomery.
Course 8a, IV Year; 1 hr. lecture per week, first term; 2 hrs. lectures per week, second term.
Composition of bodies made by using non-metallic minerals, with special reference to refractories, whiteware, and porcelain.

566. Glass and Enamels. R. J. Montgomery.
Course 8a, IV Year; 1 hr. lecture per week, both terms.
Composition and manufacture of glass and iron enamels.

568. Industrial Minerals Laboratory. R. J. Montgomery.
Course 8a, IV Year; 9 hrs. laboratory per week, first term; 6 hrs. laboratory per week, second term.
Advanced work on the compounding and testing of non-metallic mineral products.

569. Building Materials; Ceramic. R. J. Montgomery.
Course 4, IV Year; 1 hr. lecture per week, both terms.
Composition, manufacture, properties, and use of ceramic building materials.

570. Glass Technology. R. J. Montgomery.
Course 6c, IV Year; 2 hrs. lectures per week, first term; 1 hr. lecture per week, second term.
A consideration of chemical reactions at high temperature, based upon the composition and properties of various glasses.

571. Glass Technology Laboratory. R. J. Montgomery.
Course 6c, IV Year; 6 hrs. laboratory per week, first term; 19 hrs. laboratory per week, second term.
Based upon subject 570.

GEOLOGICAL SCIENCES

MINERALOGY AND PETROGRAPHY

580. Elementary Mineralogy. E. W. Nuffield.
Courses 2 and 9, I Year; 2 hrs. lectures per week, second term.
An introductory course in general and descriptive mineralogy.
Text book: Dana's Manual of Mineralogy—Hurlbut.

581. Introductory Mineralogy. V. B. Meen.
Courses 6, 8, and 8a, I Year; 2 hrs. lectures and laboratory per week, second term.
A brief study of the common minerals.
Reference book: Dana's Manual of Mineralogy—Hurlbut.

582. Elementary Petrography. V. B. Meen.
Course 1, III Year; 2 hrs. lectures and laboratory per week, first term.
A brief study of rock-forming minerals and rocks.
Text book: Handbook of Rocks—Kemp-Grout.

583. Elementary Mineralogy Laboratory. R. M. Thompson.
Courses 2 and 9, I Year; 1 hr. laboratory per week, second term.
A practical course to accompany subject 580.
Reference book: Dana's Manual of Mineralogy—Hurlbut.

587. Elementary Petrography. V. B. Meen.
Courses 2 and 9, II Year; Course 5g, III Year; 1 hr. lecture and laboratory per week, both terms.
A brief study of rock-forming minerals and rocks.
Text book: Handbook of Rocks—Kemp-Grout.

589. Blowpipe Analysis. R. M. Thompson.
Courses 2 and 9, II Year; 2 hrs. laboratory per week, second term.
Determination of minerals by means of blowpipe and physical properties.
Reference book: Dana's Manual of Mineralogy—Hurlbut.

590. Advanced Petrography. W. W. Moorhouse.
Course 9, III Year; Course 5g, IV Year; 1 hr. lecture per week, both terms.
Microscopic characters of the rock-forming minerals in thin sections, and description and classification of rocks, continuing subject 587.
Text books: Optical Mineralogy—Rogers and Kerr. Petrology for Students—Harker.

591. Advanced Petrography Laboratory. W. W. Moorhouse.
Course 9, III Year; Course 5g, IV Year; 2 hrs. laboratory per week, both terms.
Microscopic petrography to accompany subject 590.
Text books: Optical Mineralogy—Rogers and Kerr. Petrology for Students—Harker.

592. Advanced Optical Mineralogy Laboratory. M. A. Peacock.
Courses 8a and 9, IV Year; 2 hrs. laboratory per week, both terms.
Determination of the non-opaque minerals by the immersion method.
Reference books: Optical Crystallography—Wahlstrom. The Microscopic Determination of the Non-opaque Minerals—Larsen and Berman.

593. Mineralography Laboratory. W. W. Moorhouse.
Course 9, IV Year; 2 hrs. laboratory per week, both terms.
A study of the common ore minerals in polished sections.
Reference book: Microscopic Determination of the Ore Minerals —Short.

594. Morphological Crystallography. M. A. Peacock.
Course 5s, IV Year; 1 hr. lecture per week, both terms.
A course on the thirty-two crystal classes, with reference to natural and artificial crystals.
Text book: The Form and Properties of Crystals—Dale.

595. General Petrography. V. B. Meen.
Course 2, III Year; 1 hr. lecture per week, second term.
Continuation of subject 587.
Text books: Optical Mineralogy—Rogers and Kerr. Petrology for Students—Harker.

596. General Petrography Laboratory. V. B. Meen.
Course 2, III Year; 2 hrs. laboratory per week, second term.
Microscopic examination of rock-forming minerals and rocks.
Text books: Optical Mineralogy—Rogers and Kerr. Petrology for Students—Harker.

597. Elementary Optical Mineralogy. V. B. Meen.
Courses 2 and 9, II Year; Courses 5g and 8a, III Year; 1 hr. lecture and laboratory per week, second term.
A preparation for the study of microscopic petrography.
Text book: Optical Mineralogy—Rogers and Kerr.

598. Elementary Mineralogy. E. W. Nuffield.
Course 5g, III Year; 2 hrs. lectures per week, first term.
An introductory course on general and descriptive mineralogy.
Text book: Dana's Manual of Mineralogy—Hurlbut.

599. Elementary Mineralogy Laboratory. E. W. Nuffield.
Course 5g, III Year; 1 hr. laboratory per week, first term.
A practical course to accompany subject 598.

MODERN LANGUAGES

610. English. W. J. T. Wright.
All courses, I Year; 1 hr. lecture per week, both terms.
The expression of ideas and the compilation and writing of engineering reports and letters; technical exposition; the necessity of accurate expression in professional writing; the value of reading.

613. German. T. Hedman.
Course 6, II Year; 1 hr. lecture per week, both terms.
A tutorial class for those who cannot present Junior Matriculation certificates in German.

614. German. T. Hedman.

Course 6, III Year; 1 hr. lecture per week, both terms.

An advanced course in scientific German.

615. German. T. Hedman.

Course 6, IV Year; 1 hr. lecture per week, both terms.

An advanced course in scientific German. Translation of scientific articles and treatises.

PHYSICAL TRAINING

640. Physical Training.

All courses, I and II Years.

The requirements for Physical Training are outlined in Section XIV.

PHYSICS

650. Properties of Matter; Mechanics and Heat. John Satterly.

Courses 5 and 10, I Year; 4 hrs. lectures, per week, both terms.

In addition to the work in the divisions indicated in the title, the subject also includes lectures and problems on calculations for science students involving curve plotting and curve fitting, and the use of the elementary calculus and statistics.

Reference books: Dynamics—Duncan and Starling. Mechanics of Fluids — Barton. Properties of Matter — Wagstaff. Heat — Stewart and Satterly (ed. Archer). Mathematical and Physical Tables—Clark. Calculus Made Easy—Thompson. Theory of Measurements—Tuttle and Satterly. Practical Geometry—Good.

651. Properties of Matter; Mechanics and Heat Laboratory. John Satterly.

Courses 5 and 10, I Year; 3 hrs. laboratory per week, both terms.

Supplementary to subject 650.

652. Elementary Magnetism and Electricity. D. S. Ainslie.

Course 5, II Year; 1 hr. lecture per week, first term; 2 hrs. lectures per week, second term.

Fundamental theory of magnetism and electricity, including the introduction of electron theory and alternating currents.

Reference books: Advanced Text-book of Magnetism and Electricity—Hutchinson. Electricity and Magnetism—Starling.

653. Elementary Light. M. F. Crawford.

Course 5, II Year; 1 hr. lecture per week, both terms.

Fundamental theory of light, including treatment of interference, diffraction, polarized light, and the introduction of geometrical optics.

Reference books: Light for Students—Edser. Introduction to Physical Optics—Robertson. Optical Measuring Instruments—Martin.

654. Acoustics.

Course 5, II Year; 1 hr. lecture per week, first term.

Fundamental theory of acoustics, including elementary treatment of architectural acoustics.

655. Physics Laboratory (Magnetism and Electricity, Light and Acoustics).

Course 5, II Year; 3 hrs. laboratory per week, first term; 6 hrs. laboratory per week, second term.

Work carried out under the direction of the staff in Physics, covering lectures dealt with in subjects 652, 653 and 654.

656. Mathematical Operations Applied to Physics.

Course 5, III Year; 1 hr. lecture per week, both terms.

The application of vector analysis to physical problems, and an elementary treatment of Fourier Series, Spherical Harmonics, Bessel functions, etc.

657. Properties of Matter. John Satterly.

Course 5, III Year; 2 hrs. lectures per week, both terms.

Advanced work on properties of matter, dealing with gravitation, elasticity, viscosity, surface tension, and kinetic theory of gases.

Reference books: Properties of Matter—Poynting and Thomson. General Properties of Matter—Newman and Searle. Applied Mathematics—Perry. Experimental Physics—Searle. Practical Physics—Watson. The Mechanical Properties of Fluids—Drysdale and others.

658. Heat. John Satterly.

Course 10, II Year; 1 hr. lecture per week, first term.

Course 5, III Year; 1 hr. lecture per week, both terms.

Thermometry and pyrometry; absolute scale of temperature, mechanical equivalent of heat, kinetic theory of gases, equations of state, low temperature work, specific heats, vaporization, fusion, expansion, transfer of heat by conduction and convection; radiation and radiation pyrometry, the second law of thermodynamics and its simple applications.

Reference books: Heat and Thermodynamics — Roberts. Methods of Measuring Temperature—E. Griffiths. A Textbook on Heat. Parts I and II—Allen and Maxwell.

659. Physical Laboratory.

Course 10, II Year; 3 hrs. laboratory per week, first term.

Course 5, III Year; 3 hrs. laboratory per week, both terms.

Experiments illustrating the principles involved in the two preceding subjects.

660. Optics. R. Richmond.

Courses 5c, 5i, and 5s, III Year; 1 hr. lecture per week, first term.

Geometrical Optics. The theory of paraxial rays and aberrations in optical systems.

Reference books: Applied Optics and Optical Design, Part One—Conrady. The Principles of Optics—Hardy and Perrin. Fundamentals of Optical Engineering—Jacobs.

661. Optics. R. Richmond.

Courses 5c, 5i, and 5s, III Year; 3 hrs. laboratory per week first term.

Supplementary to subject 660.

662. Hydrodynamics.

Course 10, III Year; 1 hr. lecture per week, both terms.

Hydrodynamics of a perfect fluid, with applications to motion in liquids and gases. Reference will be made to some of the simpler cases of viscous flow. The course will be illustrated by experiments.

Text books: Treatise on Hydromechanics—Ramsay. Aerofoil and Airscrew Theory—Glauert. The Physics of Solids and Fluids—Ewald, Poschl and Prandtl. Hydro and Aeromechanics—Prandtl-Tietjens.

663. Introduction to Atomic and Molecular Physics. Miss E. J. Allin.

Courses 5c and 5s, IV Year; 1 hr. lecture per week, both terms.

Kinetic theory of gases, electrical discharge through gases, the electron, elementary X-rays and crystal structure, ionization, the development of radioactivity and its use in the physical and geological sciences.

Text book: The 'Particles' of Modern Physics—Stranathan.

Reference books: The Atom—Andrade. Radioactivity—Rutherford, Chadwick and Ellis. Heat—Poynting and Thomson. Kinetic Theory of Gases—Jeans.

664. Advanced Acoustics.

Courses 5c, 5s and 5i, IV Year; 1 hr. lecture per week, first term.

Properties and transmissions of acoustical waves. Analogies in alternating current theory and other fields in physics. Sound filters.

665. Physical Laboratory. H. J. C. Ireton.

Course 5c, IV Year; 3 hrs. laboratory per week, both terms.

Course 5s, IV Year; 9 hrs. laboratory per week, first term; 12 hrs. laboratory per week, second term.

Accompanying the lecture subjects 663, 664, 666, 667, 668, and 669.

666. Advanced Optics. M. F. Crawford.

Course 5s, IV Year; 1 hr. lecture per week, both terms.

Principles and applications of various types of spectroscopic instruments. Interference, diffraction, and polarisation; refractometers and polarimeters.

Text books: Applied Optics—Martin. Course d'Optique—Bruhat. The Diffraction of Light, X-Rays, Etc.—Meyer. Applied Optics and Optical Design—Conrady.

667. Series Spectra. H. J. C. Ireton.

Course 5s, IV Year; 1 hr. lecture per week, second term.

Early developments in atomic spectroscopy, the origin of spectral lines, and their empirical classification into series. Application of the derived formulæ to hydrogen, helium, and the alkali metals is given.

Reference book: Introduction to Modern Physics—Richtmyer and Kennard.

668. Elementary Quantum Theory. Miss E. J. Allin.

Course 5s, IV Year; 1 hr. lecture per week, first term.

The fundamental principles of the quantum theory developed from a historical and experimental standpoint, radiation formulæ, photoelectric effect, Compton effect, specific heats.

669. Analysis of Materials by Spectrographic and X-Ray Methods.

Course 5s, IV Year; 1 hr. lecture per week, both terms.

Qualitative and quantitative methods of spectro-chemical analysis of materials. The physical properties of X-rays, their production and applications to crystal structure.

Reference books: Applied X-Rays—Clark. Chemical Spectroscopy—Brode. Optical Methods of Chemical Analysis—Gibb.

670. Exploration Geophysics. A. A. Brant, N. B. Keevil, J. H. Hodgson.

Course 5g, IV Year; 2 hrs. lectures per week, both terms.

Physical principles underlying geophysical methods used in locating mineral deposits. Particular attention is given to magnetic, electrical, electromagnetic, gravitational, seismological, theremometric, and radioactive methods.

Reference books: Geophysical Exploration—Heiland. Exploration Geophysics—Jakosky. Imperial Geophysical Exploration Survey, Broughton—Edge and Laby. Applied Geophysics—Eve and Keys.

671. Geophysics. A. A. Brant, N. B. Keevil, J. H. Hodgson.

Course 5g, IV Year; 9 hrs. laboratory per week, both terms.

Course 9, IV Year; 6 hrs. laboratory per week, both terms.

A laboratory course accompanying subject 670 to illustrate the physical principles and measurements involved in geophysical field work, the mapping and interpretation of survey data.

672. Physics of the Earth. J. T. Wilson, A. A. Brant, N. B. Keevil, J. H. Hodgson.

Course 5g, IV Year; 2 hrs. lectures per week, both terms.

Basic considerations of gravitation; the figure of the earth and

isostacy; terrestrial magnetism and atmospheric electricity; seismology; internal structure and constitution of the earth; radioactivity, geothermal heat and the age of the earth.

673. Physics of Light Production. H. J. C. Ireton.
Courses 5i and 5r, IV Year; 2 hrs. lectures per week, first term.
Black body radiation, spectral energy distribution, and the principles involved in the production of light in various types of sources, filament, flame, gaseous, and vapour tubes.

674. Physical Laboratory. H. J. C. Ireton.
Course 5i, IV Year; 3 hrs. laboratory per week, both terms.
Accompanying subject 673.

675. Exploration Geophysics. A. A. Brant, N. B. Keevil, J. H. Hodgson.
Course 9, IV Year; 2 hrs. lectures per week, both terms.
Similar in all respects to course 670.

PRACTICAL EXPERIENCE

690. Practical Experience.
Course 1.
Every student in Civil Engineering is urged to obtain the maximum amount of practical experience possible, during the summer vacations of his course. He must, before graduation, present satisfactory evidence of having had an experience of at least 600 hours on work acceptable to the Department. He is required to submit to the Department by the first day of the Session a report of not less than fifteen hundred words on the work in which he has been engaged during the summer. Failure to meet these requirements will result in a condition in practical experience.

691. Practical Experience.
Course 2.
Every student in Mining Engineering is required to present, before graduation, satisfactory evidence of having had at least six months' practical experience in work connected with Mining, Metallurgy, or Geology, for which he must have received regular wages.

The time may be spent in geological survey, ore dressing, smelter, or lixiviation works, in prospecting, or on any work in or about a mine other than as an office man or clerk. Prospecting will count only one-half (e.g., four months' prospecting will be counted as two months) and must not be submitted for more than three of the six months. Not more than three months on geological surveys or in assaying will be accepted as part of the six months. It is important to note that this experience may be obtained before the student is admitted to the University.

692. Practical Experience.

Course 3.

Every student in Mechanical Engineering is required to spend 1200 hours in mechanical work satisfactory to the Department. Half of this work is required to be done before February of his Third Year and the balance before February of his Fourth Year. Proof is to be given the Department before the dates mentioned.

All or any part of this shop work may be completed before the student enters the University, and he is urged to complete all of it at as early a date in his course as possible.

Failure to meet the specified requirements within the time set will result in a condition in shop work.

Certificate forms for this work may be obtained from the Department of Mechanical Engineering.

(*a*) Third Year—600 hours.

The student is required to obtain this practical experience in industry, preferably in the foundry, the forge shop, and the machine shop. Such work assists the student in his understanding of the lecture and laboratory work throughout his entire course in Mechanical Engineering, and particularly the design work in his Third and Fourth Years.

Instruction regarding the type of work which is acceptable, and any special requirements, will be given by the Department to the student during his Second Year.

(*b*) Fourth Year—the balance of 1200 hours.

This is a continuation of the work outlined for the Third Year.

Instruction regarding the type of work which is acceptable, and any special requirements, will be given by the Department to the student during his Third Year.

693. Practical Experience.

Course 4.

Every student in the School of Architecture is required to spend at least 12 months (1,900 hrs.) in practical work and satisfactory evidence of its completion must be submitted before the granting of a degree. This work is done during the summer vacations, and is normally done in an architect's office for the whole period of 12 months. A student may, on application to the School of Architecture, be given permission to spend up to 6 months of this period with an engineer, a recognized contractor, or other firm conducting work in connection with building. At least 6 months' practical work in a recognized architect's office is obligatory.

695. Practical Experience.

Course 7.

Every student in Electrical Engineering is required to submit,

before graduation, satisfactory evidence of having had at least 1200 hours' experience in work connected with engineering practice. Certificate forms may be obtained from the Department of Electrical Engineering and the completed certificates should be returned to the Department as soon as possible after the completion of each period of work.

696. Practical Experience.

Course 9.

Every student in Mining Geology is required to submit, before graduation, satisfactory evidence that he has spent at least six months in field work. This work may consist of prospecting, work around mines, or service on geological field parties.

698. Practical Experience.

Course 11.

Each student in this course is required to spend 1200 hours doing practical work, before graduation. This time should preferably be spent in the actual performance of manufacturing or constructional operations in industrial plants or engineering enterprises. Such experience will be valuable in promoting a better understanding of lectures and laboratory work and will assist the student in appreciating the workers' viewpoint.

SURVEYING

710. Surveying. J. W. Melson, T. L. Rowe, H. L. Macklin, G. A. Lorimer, J. E. Jackson.

Courses 1, 2, 3, 5, 6, 7, 8, 8a, 9 and 10, I Year; 1 hr. lecture per week, first term.

General principles and practice of surveying with the chain, the transit, and the level, with special attention given to co-ordinative surveying.

Text books: Plane Surveying—Tracy. Elementary Surveying—Breed and Hosmer. Surveying—Breed. Printed Notes on Elementary Surveying—The Staff in Surveying.

711. Surveying. T. L. Rowe

Course 4, I Year; 1 hr. lecture and 3 hrs. field work per week, first term.

General principles and practice of surveying with the chain, transit, and level, with special consideration given to the survey of lots and small estates.

712. Field Work. J. W. Melson, T. L. Rowe, H. L. Macklin, J. E. Jackson, G. A. Lorimer.

Courses 1, 2, 3, 5, 6, 7, 8, 8a, 9 and 10, I Year; 3 hrs. per week, first term.

Practice in chaining; a complete survey of a piece of land with the chain and transit; keeping of field notes; the use of the transit in surveying closed figures and traverse lines, and in ranging straight lines; plotting by latitudes and departures and otherwise computing areas; instrumental work with the level; use of level and transit in setting out a proposed building and calculating the volume of excavations required.

714. Surveying. W. M. Treadgold, H. L. Macklin, G. A. Lorimer.

Course 1, II Year; 1 hr. lecture per week, both terms.

Simple, reverse, and compound curves as applied to railroad and highway surveying. Stadia, plane table, and photographic surveying as applied to topographic work, and the main features of mine, hydrographic, and aerial surveying.

Text books: Searles, Allen (Field books for Engineers). Theory and Practice of Surveying—Davis, Foote and Rayner. Surveying—Breed and Hosmer. Printed Lecture Notes—W. M. Treadgold.

715. Surveying. E. W. Banting.

Courses 2 and 9, II Year; 1 hr. lecture per week, both terms.

Mine surveying, with problems related thereto. Simple curves, stadia and plane table topographical surveying.

Text books: Surveying—Breed and Hosmer. Mine Surveying—Durham. Introduction to Mine Surveying—Staley.

716. Field Work. W. M. Treadgold, H. L. Macklin, G. A. Lorimer.

Course 1, II Year; 8 hrs. per week, first term.

Courses 2 and 9, II Year; 6 hrs. per week, first term.

Adjustments of the transit and level, minor problems in triangulation and traversing, levelling and plane table practice, curves and topography.

717. Construction Surveying. W. M. Treadgold.

Course 1, III Year; 1 hr. lecture per week, both terms.

Construction surveys are taken up under the following headings, and the work is treated as applying equally to railroads, highways, canals, transmission lines, etc.

Earthwork:

(*a*) Cross sectioning.

(*b*) Computation of volume.

(*c*) Mass or haul diagram.

Transition and Vertical curves (including super-elevation).

Railway turnouts and sidings.

Layout of roads and sewers.

Text books: Field Engineering—Searles. Railroad Curves and Earthwork—Allen. Route Surveying—Pickles and Wiley. Printed Notes—W. M. Treadgold.

718. Advanced Surveying. W. M. Treadgold, J. W. Melson.

Course 1b, IV Year; 2 hrs. lectures per week, second term.

Lectures in precise surveying in primary traverses, base line measurement, and field triangulation; determination of geodetic positions.

719. Advanced Surveying. W. M. Treadgold, J. W. Melson.

Course 1b, IV Year; 4 hrs. practical work per week, second term.

Adjustment of observations, application of Least Squares, and base line measurements.

720. Survey Camp. W. M. Treadgold, E. W. Banting, J. W. Melson, T. L. Rowe, H. L. Macklin, G. B. Langford, W. W. Moorhouse.

Courses 1, 2 and 9, III Year, August 10 to September 19.

This course includes:

(*a*) Secondary Triangulation and Base Line Measurements.
(*b*) Stadia, Plane Table and Boundary Traverses.
(*c*) Highway and Railway Location.
(*d*) Cross Sectioning and Computation of Earthwork.
(*e*) Stream Gauging and Discharge Measurements.
(*f*) Hydrographic Surveying.
(*g*) Photographic and Micrometer Work.
(*h*) Stadia and Plane Table Topography.
(*i*) Mine Surveying.
(*j*) Observations for Time, Azimuth, and Latitude.
(*k*) Geological Survey.

Students in Courses 1, 2 and 9 will be required to take the Survey Camp between the Second and Third Years; on failure to do so, this subject will be carried as a supplemental in the Third Year.

THESIS

730. Thesis.

Course 1, IV Year.

Each student of the Fourth Year, Course 1, is required to prepare and present a thesis on an approved subject, in both oral and written form. Instructions regarding the form of the thesis, and the selection of subject, are given to students at the end of their Third Year. The written thesis must be submitted not later than the last day of the Fall term of the Fourth Year of study. Oral presentation of the theses is arranged for the Spring term during regularly assigned lecture periods.

731. Thesis.

Course 2, IV Year; 7 hrs. per week, both terms.

The thesis in this Course consists mainly of reports on original work done in the laboratories. In the Third Year the subject "Introductory Research" paves the way for the thesis. By October 15th the student decides on the subject of his thesis, in consultation with his professors. After this is decided the student uses his own initiative in the development of his work.

The thesis is divided into three parts. The first part, which is handed in not later than October 15th, contains the title, a statement of what the title is meant to convey, and an outline of the work proposed to be done. The second part is handed in during the first week of January, and contains a report of progress to date; it also enables the professor in charge to keep in closer touch with the work. The third and final part is handed in two weeks before the beginning of examinations, and is a report of progress to date with final conclusions. The three parts combined constitute the thesis. There will also be required such additional written reports as may be deemed necessary by the Department.

732. Thesis.

Course 3, IV Year.

Printed instructions regarding thesis requirements are issued to each student by the Department of Mechanical Engineering, giving full particulars.

733. Thesis.

Course 5, IV Year.

Each student in the Fouth Year will be required to prepare a thesis on a subject approved by the Committee Administering the Course in Engineering Physics.

734. Thesis.

Course 6, IV Year.

The thesis describes the research work carried on by the student during four and a half months of the session. It must be typewritten on unruled $8\frac{1}{2}'' \times 11''$ paper, accompanied by graphs and photographs where necessary. The unbound sheets are handed to the Department about April 15th, and are bound in board covers by the University Press.

735. Thesis.

Course 7, IV Year.

Each student is required to prepare a thesis on a subject approved by the Head of the Department of Electrical Engineering. Instructions regarding the form of the thesis will be given to the students at the end of the Third Year.

736. Thesis.

Course 8, IV Year.

Each student in the Fourth Year must prepare a thesis on a subject and in a form approved by the Head of the Department of Metallurgical Engineering.

The most usual type of thesis is on the result of extended search and reading in a specialized field of metallurgical theory or practice.

737. Thesis.

Course 8a, IV Year.

A written report of approximately 6000 words, on a subject approved by the Department. Material for this report is obtained from laboratory and library work, which is carried out under the supervision of a member of the staff.

738. Thesis.

Course 9, IV Year; 6 hrs. per week, both terms.

A report on an investigation made by the student. It is intended to test his ability to make an independent field or laboratory study of some geological problem. The problem chosen must be approved by the Committee Administering the Course in Mining Geology, and plans for the thesis completed not later than November 1st of the student's Fourth Year.

739. Thesis.

Course 10, IV Year.

Each student of the Fourth Year must prepare a written thesis on an approved subject of a length not less than 6000 words. This thesis is to be finished and submitted for binding on the first day of the second term.

740. Thesis.

Course 11, IV Year.

Each student in the Fouth Year, Course 11, is required to prepare and present, in both oral and written form, a thesis on an approved subject in the field of management. Instructions regarding the form of the thesis and the selection of subject are given toward the end of the Third Year.

ZYMOLOGY

750. Zymology. A. M. Wynne.

Course 6z, IV Year, in the field of management.

Properties of enzymes, the mechanism of enzyme action, oxidation in living cells, and the intermediary carbohydrate metabolism of yeast, bacteria, and animal tissues.

SECTION X. EXAMINATIONS

ANNUAL EXAMINATIONS

1. Annual examinations will be held in April except as provided in paragraph 2 below.

2. Annual examinations will be held at the beginning of the second term in all subjects completed during the first term.

3. Promotions from one year to another are made on the results of term work and the annual examinations. A student proceeding to a degree must pass in all term work and examinations in all subjects of his course, and at the periods arranged by the Council.

4. The pass marks required on written examinations and laboratory work of all departments are 50 per cent, with an average of 55 per cent on written examinations and an average of 55 per cent on laboratory work. Candidates who have attained the required average and who have failed in not more than two subjects will be required to pass supplemental examinations in those subjects to secure pass standing.

5. Honours will be granted to students who, at the annual examinations, obtain at least 50 per cent in each written subject, at least 60 per cent in each laboratory subject, and 75 per cent of the total number of marks allotted to the subjects of their course.

6. Honour graduate standing will be granted to those who obtain honours in the final year and in one previous year.

7. Candidates who fail to secure promotion in the First and Second Years will not be allowed to repeat the work of the year until at least one academic year has elapsed.

8. A student who fails in the work of any year may petition the Council to be allowed to repeat the work of the year. If the petition is granted, registration will be provisional only and will be so endorsed on his resignation card.

9. A student will not be allowed to repeat the work of more than one year in his entire undergraduate course.

10. A student who, in either term of the session, fails to perform satisfactorily the work of his course may not be allowed to present himself at the final examinations of the year.

11. A student should submit to Council immediately after its occurrence, evidence of any illness or mishap which occurs during the session; any petition for leniency on account of such incidents may be refused consideration if received after the third day following the last day of examinations.

12. A student who has failed to complete satisfactorily the course in Physical Training prescribed for the First Year will not be permitted to register in the Third Year; and a student who has failed to complete satisfactorily the course in Physical Training prescribed for the Second Year will not be permitted to register in the Fourth Year.

13. A student will not be allowed to write any examinations if he has not paid all fees and dues for which he is liable at that time.

SUPPLEMENTAL EXAMINATIONS

1. The supplemental written examinations will begin on the 9th day of September, 1946. Application (on the prescribed form) to take such examinations, including practical ones, must be received from the candidate by the Secretary of the Faculty not later than July 15th, and the fee named in Sec. VI, para. 11, received by the Bursar not later than September 1st. Council reserves the right to reject applications of, or impose penalties upon, those failing to comply with these requirements. Arrangements will be made to conduct supplemental examinations at the Survey Camp for those students in attendance at the Camp.

2. If a candidate desires to write upon an annual examination as a supplemental, his application must be received by the Secretary and his fee by the Bursar, for the January examinations not later than December 1st and for the April examinations not later than March 1st.

3. Except under very exceptional circumstances, pass standing must be obtained in all written supplementals before entering the next higher year, and in all laboratory supplementals before or during the Session of the next higher year as may be required by the Department concerned.

TERM EXAMINATIONS

Term examinations may be held in any subject and at any time at the discretion of the instructor, or by order of the Council, and the results of such examination may, if the Council so decides, be incorporated with those of the annual examinations in the same subjects.

EX-SERVICE PERSONNEL

The foregoing regulations are applicable to all students of the Faculty. Special problems of students who have served in His Majesty's Armed Forces will be considered individually by the Council.

SECTION XI. SCHOLARSHIPS, AWARDS AND LOANS

Through the generosity of friends of the University, governments and commercial organizations, encouragement has been given to both undergraduate and graduate work in the various branches of engineering studies by establishing the following scholarships, prizes, bursaries, and medals.

Matriculation students are advised to consult the University of Toronto Calendar on Admission Requirements and Scholarships for complete details of awards available to students entering this Faculty.

Where it is necessary to make application for an award it is so stated in the description and particulars are given as to how the application should be made. In all other cases the award is made on the recommendation of the Faculty Council and no application is necessary.

A student will not be allowed to hold more than one scholarship of those marked by an asterisk, or otherwise designated, in any one year. The student obtaining highest standing in his year and a student winning more than one award will be so shown in the published results. The Council may, at its discretion, award unallocated scholarships to the next eligible candidate.

Name	Amount	Application required	Available only to a limited group or single course	See page
AVAILABLE TO STUDENTS ENTERING THE FIRST YEAR				
Applied Science Bursaries	$1750	Yes	No	158
Emerson Wickett Memorial Scholarship	$100	Yes	No	159
Hagerty Memorial Scholarship	$60	Yes	Yes	159
U.T.S. Engineering Scholarship	$250	Yes	Yes	160
The Leonard Foundation Scholarships		Yes	Yes	160
The Robert Simpson Company Scholarship	$100	Yes	Yes	160
O.H.A. War Memorial Scholarship	$200	Yes	Yes	161
AVAILABLE TO STUDENTS COMPLETING THE FIRST YEAR				
U. of T. War Memorial Scholarships	$250	Yes	No	161
*Baptie Scholarship	$100	No	Yes	161

Name	Amount	Application required	Available only to a group or single course	See page
MacLennan-MacLeod Memorial Prize	$25	No	No	162
*Ransom Scholarship in Chemical Engineering	$150	No	Yes	162
T. H. Bickle Bursary	$30	No	Yes	163
*John M. Empey Scholarship	$100	No	No	163
AVAILABLE TO STUDENTS COMPLETING THE SECOND YEAR				
Rhodes Scholarship	£400	Yes	No	168
U. of T. War Memorial Scholarships	$250	Yes	No	161
*Harvey Aggett Memorial Scholarship	$75	No	No	163
Ontario Association of Architects Scholarship	$100	No	Yes	163
J. A. Findlay Scholarship		No	Yes	164
*Association of Professional Engineers of the Province of Ontario	$175	No	Yes	164
T. H. Bickle Bursary	$30	No	Yes	163
1923 Engineering Alumni Bursary	$150	Yes	No	164
Women's Mining Association Scholarship	$150	Yes	Yes	165
*Garnet W. McKee-Lachlan Gilchrist Geophysics Scholarships		No	Yes	172
*John M. Empey Scholarship	$100	No	No	163
W. G. Millar Memorial Scholarship	$250	Yes	Yes	172
AVAILABLE TO STUDENTS COMPLETING THE THIRD YEAR				
Rhodes Scholarship	£400	Yes	No	168
*Boiler Inspection and Insurance Company Scholarship	$150	No	Yes	165
U. of T. War Memorial Scholarships	$250	Yes	No	161

Name	Amount	Application required	Available only to a limited group or single course	See page
*Jenkins Scholarship in Engineering	$200	No	No	165
Heating and Ventilating Engineers Prize	$25	No	No	166
E.I.C. Prize	$25	No	Yes	166
Engineering Society Semi-Centennial Award	$75	No	No	166
J. A. Findlay Scholarship		No	Yes	164
*Association of Professional Engineers of the Province of Ontario Scholarships	$225	No	Yes	164
T. H. Bickle Bursary	$30	No	Yes	163
1923 Engineering Alumni Bursary	$150	Yes	No	164
Women's Mining Association Bursary	$150	Yes	Yes	165
Archie B. Crealock Memorial Prize	$25	No	Yes	166
*John M. Empey Scholarship	$100	No	No	163
Hudson Bay Mining and Smelting Company Limited Scholarships	$800	Yes	Yes	167
AVAILABLE TO STUDENTS COMPLETING THE FOURTH YEAR				
B.A.A.S. Medal		No	No	167
Heating and Ventilating Engineers Prize	$25	No	No	166
INCO. Scholarship	$500	Yes	Yes	167
Hobbs Glass Limited Scholarship	$250	No	Yes	167
Class of '35 Award	$100	No	No	167
AVAILABLE TO STUDENTS COMPLETING THE FIFTH YEAR				
Toronto Architectural Guild Medal		No	Yes	168
Toronto Brick Company Prizes	$100	No	Yes	168
R.A.I.C. Medal		No	Yes	168

Name	Amount	Application required	Available only to a limited group or single course	See page
AVAILABLE TO GRADUATES				
Rhodes Scholarship	£400	Yes	No	168
1851 Exhibition Science Research Scholarships	£275	Yes	Yes	169
McCharles Prize	$1000	No	No	171
Nipissing Mining Research Fellowships	$1100	Yes	No	171
H. W. Price Research Fellowship on Electrical Engineering		Yes	Yes	171
C.I.L. Fellowship in Chemistry	$750	Yes	No	171
T. A. Russell Memorial Research Fellowship	$1000	Yes	Yes	171
Consolidated Mining and Smelting Company Fellowship	$750	Yes	No	173
Canadian Institute of Steel Construction Research Fellowship	$1200	Yes	No	173
Canadian Lumbermen's Association Timber Research Fellowship	$1000	Yes	No	173

NOTE: On account of the continued tendency towards lower rates of interest it is possible that the value of certain scholarships or prizes at the time of payment may prove to be less than the amount stated in the calendar.

APPLIED SCIENCE BURSARIES

To assist promising students in the secondary schools who would otherwise be prevented for financial reasons from entering the Faculty of Applied Science, the Board of Governors has allocated funds to assist such persons to commence work at the University. Eleven Bursaries, each amounting to $150, will be awarded in 1946 to those applicants who are considered by the Council of the Faculty to be most eligible. An applicant must have obtained First Class Honours in Mathematics and a high proficiency record in the remaining subjects at the Grade XIII examinations for the Province of Ontario, or their equivalent.

Each applicant must apply by letter, giving full particulars of his case, to the Secretary of the Faculty of Applied Science and Engineering not

later than September 1, 1946. This application must be accompanied by a letter of recommendation from the principal of the secondary school where his standing was obtained, and if possible a second letter of recommendation from a graduate in engineering, preferably of the University of Toronto, who resides or practises in the vicinity. Application for admission to the University, accompanied by matriculation certificates, must also be submitted to the Registrar of the University at the same time that application for the Bursary is submitted to the Secretary of the Faculty. Some members of the engineering profession have agreed to act as counsellors to prospective students, and the name of one or more of these men residing in the neighbourhood of the applicant may be obtained on application to the Secretary of the Faculty.

THE EMERSON WICKETT MEMORIAL SCHOLARSHIP

The Emerson Wickett Memorial Scholarship, the gift of Mrs. Maude Wickett Kilbourn, in memory of her brother, the late William Emerson Wickett, a graduate of the Faculty of Applied Science and Engineering in 1906, of the value of $100, is awarded to the candidate who, at one examination, obtains standing with the highest average percentage in the subjects of Grade XIII prescribed for admission to the Faculty. An award will not be made in any year in which no candidate obtains an average of at least seventy-five per cent. Application should be made to the Registrar of the University.

THE REGINALD AND GALER HAGARTY SCHOLARSHIP

The Reginald and Galer Hagarty Scholarship, in memory of the dearly beloved sons of Lieutenant-Colonel E. W. Hagarty, B.A. 1883, M.A. 1908, and Charlotte Ellen Hagarty, his wife. Reginald Edward Walter Hagarty, B.A.Sc. (Honours) 1908, a graduate of the University in the Faculty of Applied Science and Engineering and at the time of his death on April 29, 1925, a Consulting Structural Engineer. Lieutenant Daniel Galer Hagarty, Princess Patricia's Canadian Light Infantry, a member of the class of 1916 in Applied Science, enlisted for the Great War at the end of his third year in June, 1915, killed in action in Sanctuary Wood, June 2, 1916. The scholarship is given in recognition of the fact that their father was an honour graduate in Classics of the University of Toronto. It is of the value of the interest on $2,000 and is to be awarded to a pupil of Harbord Collegiate Institute, Toronto, who at the Grade XIII examinations in the subjects of English, French, Latin and Mathematics stands highest among the students of that school who (*a*) register in the Faculty of Applied Science and Engineering, (*b*) sign a declaration to the effect that they are willing to take up arms in defence of Canada and the British Empire should necessity arise as declared by the Parliament of Canada and (*c*) obtain at least a pass mark in each of the said subjects. The scholarship was offered for award for the first time in 1945. Application should be made to the Registrar of the University.

THE U.T.S. ENGINEERING SCHOLARSHIP

The U.T.S. Engineering Scholarship, the gift of R. A. Bryce, Esq., of the value of $250. The scholarship will be awarded by a committee of the Staff of the University of Toronto Schools to a student of the Schools who has completed the requirements for admission to and enrols in the Faculty of Applied Science and Engineering.

THE LEONARD FOUNDATION SCHOLARSHIPS

Leonard Foundation Scholarships are awarded each year to selected students in Universities and Colleges across Canada, including the University of Toronto. The Trust Deed States: "Preference in the selection of students for scholarships shall be given to the sons and daughters respectively of the following classes: (*a*) clergymen, (*b*) school teachers, (*c*) officers, non-commissioned officers and men, whether active or retired, who have served in His Majesty's military, naval or air forces, (*d*) graduates of the Royal Military College of Canada, (*e*) members of the Engineering Institute of Canada, (*f*) members of the Mining and Metallurgical Institute of Canada."

Further information regarding the procedure to be followed in applying for these scholarships may be obtained by writing to Dr. W. E. Taylor, Honorary Secretary, The Leonard Foundation, c/o Toronto General Trusts Corporation, 253 Bay Street, Toronto.

THE ROBERT SIMPSON COMPANY LIMITED NORTHERN ONTARIO SCHOLARSHIPS

These scholarships, the gift of the Robert Simpson Company Limited, are open only to students of secondary schools from North Bay west as far as Sudbury and Copper Cliff, and from North Bay north along the T. and N.O. Railway, in which instruction is given in Grade XIII. A scholarship of the value of $100 is available for each of the schools mentioned and an additional sum of $50 will be given to the student who obtains the highest percentage on the nine papers of Grade XIII selected in accordance with the regulations.

No scholarship will be awarded unless the candidate is in actual attendance in one of the colleges or faculties of the University and maintains a uniformly high standard to the satisfaction of the donors of the scholarships.

Applications for these scholarships must be sent not later than May 15th, to the Principal of the North Bay Collegiate Institute, from whom further information may be obtained regarding the conditions of award.

THE ONTARIO HOCKEY ASSOCIATION WAR MEMORIAL SCHOLARSHIP

The Ontario Hockey Association War Memorial Scholarship, the gift of the Ontario Hockey Association, is to be awarded annually at the Grade XIII examination to a man student who has served overseas with the Canadian forces in the Great War of 1914-1918, or to a student who is the son or daughter of one who has so served.

The value of this scholarship is $100 in cash, with an allowance of the same amount on the tuition fee for each session.

In determining the award of the scholarship, the academic qualifications of the candidates shall be first taken into account, provided always that no candidate shall be eligible for an award who has not met all the conditions required by the University of candidates for admission scholarships generally; but, *cœteris paribus*, the award shall be made to a student who is in proved need of assistance.

The award shall be made by the Senate of the University upon the report of a committee to be appointed by the Senate, upon which committee there shall be always one member of the Staff of the University who shall be deemed to be the representative of the Association.

Candidates shall make application not later than May 1st on the special form to be obtained from the Registrar of the University.

UNIVERSITY OF TORONTO WAR MEMORIAL SCHOLARSHIPS

Four scholarships, each of the value of Two Hundred and Fifty Dollars, have been established by the Alumni Federation of the University from the War Memorial Fund to be awarded to students in the Faculties of Applied Science and Engineering, and Forestry.

The general basis on which scholarships may be awarded shall be as follows: (*a*) Standing in course of studies. (*b*) Relationship to active service in the Armed Forces of Canada. (*c*) Need of financial assistance. (*d*) Merit shown by participation and interest in extra-curricular undergraduate activities of the University. (*e*) Such other general qualifications as may commend themselves to the committee recommending the awards.

Information regarding these scholarships may be obtained from the Secretary-Treasurer of the Alumni Federation, 43 St. George St., to whom application for the same must be made before April 15th.

BAPTIE SCHOLARSHIP

The Baptie Scholarship is derived from a bequest under the will of the late Mrs. Margaret W. Baptie, of Ottawa, and the Board of Governors has directed that from the income a scholarship of One Hundred Dollars shall be awarded annually to an engineering student on the record of the First Year. The Board of Governors also authorizes a remission of fees in the case of the holder of the scholarship, up to Seventy-five Dollars.

The conditions of the award are as follows: That the scholarship be awarded to the student who, in the annual examinations of the First Year, enrolled in any one of the courses of Civil Engineering, Mining Engineering, Mechanical Engineering, Chemical Engineering, Electrical Engineering, or Metallurgical Engineering, obtains the highest aggregate percentage of marks in those subjects which are common to the First Year curricula of those courses. The first award was made on the results of the annual examinations of the Session 1925-26.

MACLENNAN-MACLEOD MEMORIAL PRIZE

The Graduating Class of 1910 has donated an annual prize to the value of Twenty-five Dollars, known as "The MacLennan-MacLeod Memorial Prize", in memory of their first Class President, George MacLennan, who was killed in action in France in 1917, and of Doug. MacLeod, their first Secretary, who died in France in 1916 from wounds received in action.

The prize is awarded to the First Year student in the Faculty of Applied Science and Engineering who ranks highest in Calculus among those who obtain standing without condition at the annual written examinations; or, in the event of more than one student obtaining equally high rank in Calculus, the award is made to the one of these who also has the highest standing in some other subject common to the competitors, such as Analytical Geometry, such subject to be determined by the Council of the Faculty.

An award will not be made in any year in which, in the opinion of the Council, no student obtains a sufficiently high standing in Calculus to merit the award. In any year in which no award is made, the income from the prize of that year will be available for a second award in any subsequent year.

RANSOM SCHOLARSHIP IN CHEMICAL ENGINEERING

The Ransom Scholarship in Chemical Engineering is presented by A. C. Ransom, Esq., of Toronto, for the purpose of encouraging and giving financial assistance to students who choose the field of Chemical Engineering. This donation, consisting of $5,000, provides for a perpetual scholarship of an annual amount such as will be derived from the income of this sum. The first award was made on the results of the annual examinations of 1938.

The scholarship will be awarded annually to the student registered in the Course in Chemical Engineering who obtains the highest aggregate percentage of marks in the examinations of the First Year. The scholarship will be paid to the winner only if he proceeds to take his Second Year in the Course in Chemical Engineering in the University of Toronto.

THE T. H. BICKLE BURSARY

The T. H. Bickle Bursary is the gift of Mr. and Mrs. E. W. Bickle in memory of their son, T. H. Bickle, an undergraduate of Trinity College and a member of the Senior Intercollegiate Swimming Team at the time of his death in 1937. The income from the endowment of $1,000 will be awarded annually to a member of the Senior Intercollegiate Swimming Team of this University in any year or faculty. The Committee of Award shall consist of the Dean of the Faculty of Arts, the University Registrar, the Director of Athletics, and the Honorary Coach of Swimming. In awarding the Bursary the Committee shall consider the character, scholarship, and general interests of the members of the team.

THE JOHN M. EMPEY SCHOLARSHIPS

The John M. Empey Scholarship Fund was established under a bequest of $10,000 in the Will of the late John Morgan Empey, B.A.Sc., 1903. Three scholarships of equal value are provided from the income from the Fund. One of these scholarships is awarded in each of the First, Second, and Third Years on the results of the annual examinations, to a student who, taking honours, obtains the highest average percentage of marks in the written and laboratory subjects of his Year. The scholarships are open to any students registered in the Faculty. In case the winner of any one of these scholarships does not attend this Faculty during the session next following the award, the right to the scholarship shall be forfeited and the award shall be made to another eligible student. The scholarships were awarded for the first time in 1944.

HARVEY AGGETT MEMORIAL SCHOLARSHIP

This scholarship was donated by the late Mr. J. T. Aggett, of Toronto, as a perpetual memorial to his son, the late Lieutenant Harvey Aggett, who enlisted in March, 1915, during his second year in this Faculty, and was killed in action at Passchendaele on 6th November, 1917.

This annual scholarship of the value of Seventy-five Dollars is to be awarded to a student of the Second Year in this Faculty who, obtaining honours and being one of the first three in his year by his standing at the annual examinations, has been adjudged highest of the three in general student activities and service in the University during his period of attendance. When regulations do not permit the winner to hold this scholarship the students to be considered for the award shall be the first three in the year exclusive of any student who holds a scholarship of higher value.

ONTARIO ASSOCIATION OF ARCHITECTS SCHOLARSHIP

The Ontario Association of Architects offers a scholarship of One Hundred Dollars to the student of the Second Year in the School of Architecture who, at the annual examinations, obtains the highest honour standing in Architectural Design. The scholarship was awarded annually from 1928 to 1940 inclusive and has been extended for a further period of five years.

J. A. FINDLAY SCHOLARSHIPS

These scholarships were established through a legacy bequeathed by the late Miss Janet Findlay to the Department of Mechanical Engineering. Two scholarships are available to students in this Course, one for a student in the Third Year, the other for a student in the Fourth Year, but only if the student continues his course in Mechanical Engineering. The selection will be made, on recommendation of the Head of the Department of Mechanical Engineering, from amongst the four students having the highest average percentage of marks at the annual examinations in the Second and Third Years respectively, but in making the award the student's general character, fitness for his profession, and financial circumstances will be given consideration. In case a student who has been awarded one of the scholarships changes his course or does not attend this University during the next following session, he shall forfeit his right to the scholarship and the award shall be made to another eligible student.

ASSOCIATION OF PROFESSIONAL ENGINEERS OF THE PROVINCE OF ONTARIO SCHOLARSHIPS

The Association of Professional Engineers of the Province of Ontario offers the following scholarships to students registered in any course of the Faculty of Applied Science and Engineering (except Architecture):—

- (*a*) Scholarships of One Hundred Dollars and Seventy-five Dollars, respectively, to the two students in the Second Year who, taking honours, obtain the highest per cent of the total number of marks allotted to the subjects of their respective courses.
- (*b*) Scholarships of One Hundred Dollars, Seventy-five Dollars and Fifty Dollars, respectively, to the three students in the Third Year who, taking honours, obtain the highest per cent of the total number of marks in their respective courses.

These scholarships will not be awarded to students who hold other scholarships.

THE 1923 ENGINEERING ALUMNI BURSARY

The Graduate Class of 1923 of the Faculty of Applied Science and Engineering has presented the 1923 Engineering Alumni Bursary, having the value of One Hundred and Fifty Dollars annually, commencing 1939. This bursary is awarded annually to a student completing the Second or the Third Year; it may be awarded two years in succession to the same student, but will usually be awarded at the end of the Second Year. The award is made by a Committee of the Class of 1923, on the following basis:

(*a*) In addition to mental capacity, the student must show leadership ability and give promise, through his activities, of becoming a worth-while influence in the affairs of the profession and the community.

(*b*) While attention is given to scholastic ability, as evidenced by his

academic standing, it is not the governing factor. He must, however, stand in the top quarter of his class.

(*c*) Special consideration is given to financial need.

Payment is made in three instalments following registration in the next year.

Information may be obtained from the General Secretary, University Alumni Federation, 43 St. George Street.

THE WOMEN'S MINING ASSOCIATION BURSARY

The Women's Mining Association has presented a Bursary having the value of One Hundred and Fifty Dollars annually, commencing 1939. The Bursary is awarded to a student entering the Third or Fourth Year in the Course in Mining Engineering, Metallurgical Engineering, or Mining Geology; it may be awarded two years in succession to the same student, but will usually be awarded at the beginning of the Third Year. The award will be made by a special committee appointed by the Association on the following basis:

(*a*) In addition to mental capacity, the student must show leadership ability and give promise, through his activities, of becoming a worthwhile influence in the affairs of the profession and the community.

(*b*) While attention is given to scholastic ability, as evidenced by his academic standing, it is not the governing factor. He must, however, stand in the top quarter of his class.

(*c*) Special consideration is given to financial need.

Application must be made to the Secretary of the Faculty within one month of the opening of the academic year.

BOILER INSPECTION AND INSURANCE COMPANY SCHOLARSHIP

The Boiler Inspection and Insurance Company of Canada offers a scholarship in the Course in Mechanical Engineering of the value of One Hundred and Fifty Dollars to the student who obtains highest honour standing in the regular examinations of the Third Year.

The successful candidate will be expected to proceed to his Fourth Year during the session next following the date of the award.

The amount of the award will be credited by the Bursar to the fees of the Fourth Year of the successful candidate.

JENKINS SCHOLARSHIP

The Jenkins Scholarship, presented by Jenkins Bros., Limited, Montreal, first awarded in 1925, has been donated to continue indefinitely.

This Annual Scholarship, of the value of Two Hundred Dollars, is awarded to the student of the Third Year registered in any course of the Faculty who has the highest aggregate of percentages for the First, Second, and Third Years.

HEATING AND VENTILATING ENGINEERS PRIZE

The Ontario Chapter of the American Society of Heating and Ventilating Engineers offers an annual prize of Twenty-five Dollars, first awarded in 1931, for a period of five years, and extended indefinitely in 1935. The prize will be awarded to a student in either the Third or Fourth Year in any Course of the Faculty who, in the opinion of the Department of Mechanical Engineering, has written the most satisfactory thesis on a subject dealing with heating or ventilation, such thesis being prepared under special arrangements made by the Department of Mechanical Engineering, the result to be reported to the Council with the annual examination results. The thesis must be handed in not later than March 1st. The prize will not necessarily be awarded in any year.

Application should be made to the Department of Mechanical Engineering.

ENGINEERING INSTITUTE OF CANADA PRIZE

The Engineering Institute of Canada, having in view that one of its objects is to facilitate the acquirement and interchange of professional knowledge among its members, offers an annual prize of Twenty-five Dollars in this University, to continue for a period of five years, commencing 1931, to the student who, in his Third Year in any one of the six courses of Engineering, has proved himself most deserving as disclosed by the examination results of the year, in combination with his activities in the Engineering Society or with a local branch of another recognized engineering organization. This prize was extended in 1935 and again in 1940 for a further period of five years.

THE ENGINEERING SOCIETY SEMI-CENTENNIAL AWARD

The Engineering Society Semi-Centennial Award, to the value of Seventy-five Dollars, was established in 1931 to commemorate the semi-centennial of the founding of the "School". The award is made to a student entering the final year.

The selection is based upon the following qualifications, which bear equal weight in the selection of the winner: (*a*) General "School" activities. (*b*) Contributions to the Engineering Society Executive Committee. (*c*) Personality, and social and athletic activities. (*d*) Academic standing.

THE ARCHIE B. CREALOCK MEMORIAL PRIZE

The Archie B. Crealock Memorial Prize is the gift of Mrs. Archie B. Crealock, in memory of her husband, an eminent bridge engineer and a graduate of the Faculty of Applied Science and Engineering of the University of Toronto. It is offered annually to the student of the Third Year in the Course in Civil Engineering, who, having obtained honours in that year, is deemed to be the most worthy of the award. The award is made primarily on the basis of academic standing in the structural subjects of the Year, but extra-curricular activities are also taken into consideration. The Prize consists of engineering books to the value of Twenty-five Dollars. The award will not necessarily be made in any year.

THE HUDSON BAY MINING AND SMELTING COMPANY LIMITED SCHOLARSHIPS

The Hudson Bay Mining and Smelting Company Limited awards Scholarships to students who have obtained their Senior Matriculation at the High Schools in Flin Flon, Manitoba, and its environs. These Scholarships, having a value of $800.00 each annually, may be held in the Third and Fourth Years in this Faculty, in the Courses in Chemical Engineering, Metallurgical Engineering, Mining Engineering, and Mining Geology. Application should be made to the Company.

B.A.A.S. MEDAL

A bronze medal has been donated by members of the British Association for the Advancement of Science, for students of the Faculty of Applied Science and Engineering. This medal will be awarded to the student of the Final Year, in any course, who, taking honours, obtains the highest aggregate percentage in practical and written examinations in the Year.

THE INCO SCHOLARSHIP

The International Nickel Company of Canada, Limited, offers a scholarship of $500.00, commencing with the Session 1941-42, and from year to year thereafter as the Company may decide, to be awarded to a graduate of the Faculty of Applied Science and Engineering in Chemical Engineering, Metallurgical Engineering, Mining Engineering or Mining Geology, who has taken a consistently high standing in the majority of the subjects of his course, and who is adjudged by the Council of the Faculty to be most suitable to receive the award.

The applicant must proceed to the M.A.Sc. degree in the Session in which he receives the scholarship. Application must be made before May 1, to the Secretary of the School of Graduate Studies, with a statement of the research problem which he proposes to study.

HOBBS GLASS, LIMITED, SCHOLARSHIP

Hobbs Glass, Limited, offers a scholarship annually, commencing with the Session 1945-46, to the student of the Fourth Year in Architecture presenting the best solution to a problem of design set by the staff in Architecture in consulation with the donor. The value of the scholarship is the Fifth Year academic fee.

CLASS OF '35 AWARD

The Class of '35, following its policy established in 1945 to stimulate the young Engineers' and Architects' sense of responsibility to the community, will make two awards, totalling $100, to the graduating class of each year, based upon evidence shown in a written essay on the liberal and humanistic phases of Engineering and Architecture. Details of the requirements and awards will be posted at the beginning of the second term of each session.

TORONTO BRICK COMPANY PRIZES

The Toronto Brick Company offers two prizes, one of Seventy-five Dollars and one of Twenty-five Dollars, to those students of the Fifth Year in the School of Architecture who win first and second places in a competition arranged by the Staff in the School of Architecture for this purpose.

TORONTO ARCHITECTURAL GUILD MEDAL

The Toronto Architectural Guild was the organization of local architects from which sprung the Ontario Association of Architects. When the new and wider association became firmly established, the Guild disbanded and handed over to a trustee board certain funds for the establishment of a medal to be awarded in the School of Architecture of the University of Toronto.

The Trustee Board, now that the fund has accumulated considerably, announces its intention of awarding this medal annually to a senior student showing outstanding ability in Architectural Design.

ROYAL ARCHITECTURAL INSTITUTE OF CANADA MEDAL

The Royal Architectural Institute of Canada has presented a medal to be awarded annually to a member of the graduating class in the School of Architecture who, having completed the requirements for the degree, has obtained high standing throughout his course and gives promise of being an architect of distinction after graduation. The person to whom the award is made must be a British subject; he must have completed the entire course in Architecture in the School of Architecture of the University of Toronto, except in the case of a graduate of the Royal Military College who shall have completed at least the third, Fourth, and Fifth Years in the School; he must have obtained high standing throughout his course, particularly in Architectural Design, and his character, personality, and intellect must be such as to indicate that in the practice of his profession, he may be expected to attain distinction. No award will be made in any Session in which the Council of the Faculty of Applied Science and Engineering so recommends.

THE RHODES SCHOLARSHIP

The Rhodes Trustees offer two scholarships for award annually in the Province of Ontario, each of the value of £400 a year and tenable ordinarily for two years at the University of Oxford. A third year is given conditionally at Oxford or elsewhere abroad.

Each candidate must be a British subject with at least five years domicile in Canada, and unmarried; he must have passed his nineteenth but not his twenty-fifth birthday on October 1st of the year for which he is elected; he must have completed the first year and have entered upon the second year of his course at a Canadian University at the time of application.

In that section of the will in which he defined the general type of scholar he desired, Mr. Rhodes mentioned four groups of qualities, the first two of which he considered most important:

(1) Literary and scholastic attainments;

(2) Qualities of manhood, truth, courage, devotion to duty, sympathy, kindliness, unselfishness, and fellowship;

(3) Exhibition of moral force of character and of instincts to lead and to take an interest in his fellows;

(4) Physical vigour, as shown by fondness for and success in outdoor sports.

Some definite quality of distinction, whether in intellect, character or personality, or in any combination of these, is the most important requirement. Financial need does not receive special consideration.

In 1945 extra scholarships were made available for "service" candidates who had had at least one year of war service, and it is expected that these extra scholarships will be offered again in 1946.

"Service" candidates are not disqualified by marriage, may deduct the war years to bring themselves within the age limits, and may apply after one year at a Canadian university.

Forms of application and full information regarding these scholarships may be obtained from D. R. Michener, Esq., 372 Bay Street, Toronto, General Secretary for Canada. Selection is made in December each year for the scholarships for the year following. Application must be made to the Secretary on or before November 10th.

THE 1851 EXHIBITION SCIENCE RESEARCH SCHOLARSHIPS

The Royal Commissioners for the Exhibition of 1851 have invited the University of Toronto to recommend annually one or more candidates in order of merit for science research scholarships, each of the value of £350 per annum and ordinarily tenable for two years. The Commissioners may make a supplementary grant up to £50 per annum for University fees, etc., payable by the scholar during his tenure of the award.

Each candidate recommended must be a British subject, and under twenty-six years of age except in very special circumstances; he must have been a student of science in a university institution for a period of not less than three years and must have spent one full academic year at this University ending not more than twelve months prior to the date of recommendation.

The record of a candidate's work must indicate high promise of capacity for advancing science or its applications by original research. Evidence of this capacity, which is the main qualification for the scholarship, is strictly required. The most suitable evidence is a satisfactory account by the candidate of research work already performed, and the Commissioners will decline to consider the claims of a candidate unless such an account is furnished, or unless there is other equally distinct evidence that he possesses this qualification.

The scholar will be required to devote his whole time to research in some branch of pure or applied science at an institution in the United Kingdom or abroad, selected with the approval of the Commissioners.

The following are the departments of the University, the students of which are eligible to apply for these scholarships: 1. Bacteriology; 2. Biochemistry; 3. Botany; 4. Chemistry; 5. Engineering; (chemical); 6. Engineering (civil); 7. Engineering (electrical); 8. Engineering (mechanical); 9. Engineering (metallurgical); 10. Engineering (mining); 11. Forestry; 12. Geological Sciences; 13. Physics; 14. Physiology; 15. Zoology.

A Student shall not be deemed to be eligible because of his being on the staff of the university, if he has not been in receipt of a salary of more than $800 per annum and the nominating board may, at its discretion, recommend candidates who have been in receipt of larger salaries provided that all other conditions are fulfilled.

A student shall be deemed to be eligible in the year in which he intends to graduate, but if nominated for the scholarship his nomination shall be subject to his being successful in passing his examination for his degree.

The nominating board consists of the following members appointed by the Senate:—the Chancellor, the President, the Provost of Trinity College, Dean Beatty, Dean Hunter, Assistant Dean Ryerson, Dean Young, Dr. C. S. MacInnes and Mr. N. F. Parkinson, and the Board shall have power to call to its aid as assessor any member of the teaching staff.

Applications for these scholarships must be submitted not later than April 15th to the University Registrar from whom copies may be obtained of the general regulations of the Commissioners governing the award and tenure of the scholarship.

McCHARLES PRIZE

This prize, the gift of the late Æneas McCharles of the value of $1,000, is awarded from time to time but not necessarily every year on the following terms and conditions: (1) to any Canadian from one end of the country to the other, and whether student or not, who invents or discovers any new and improved process for the treatment of Canadian ores or minerals of any kind, after such process has been proved to be of special merit on a practical scale; (2) or for any important discovery, invention or device by any Canadian that will lessen the dangers and loss of life in connection with the use of electricity in supplying power and light (3) or for any marked public distinction achieved by any Canadian in scientific research in any useful practical line. The following conditions determine the method of award:—

(1) The title shall be the McCharles Prize.

(2) The value of the prize shall be One Thousand Dollars ($1,000.00) in money.

(3) Every candidate for the prize shall be proposed as such in writing

by some duly qualified person. A direct application for a prize shall not be considered.

(4) The composition of the awarding body shall be as follows:—

An expert in Mineralogy,
An expert in Electricity,
An expert in Physics,

and four other persons. All of the members of this body shall be nominated by the Board of Governors of the University of Toronto.

NIPISSING MINING COMPANY RESEARCH FELLOWSHIP

The Nipissing Mining Company has endowed a Research Fellowship in the Department of Mining Engineering, to be known as The Nipissing Mining Company Research Fellowship, of the annual value of Eleven Hundred Dollars.

This Fellowship is open to graduates of any University.

THE H. W. PRICE RESEARCH FELLOWSHIP IN ELECTRICAL ENGINEERING

The H. W. Price Research Fellowship in Electrical Engineering consisting of the income derived from the sum of $10,000 donated by the Hydro Electric Power Commission of Ontario, will be awarded from time to time to a graduate in Electrical Engineering of any recognized University, registered in the School of Graduate Studies, wishing to proceed with an investigation in the field of Electrical Engineering.

Forms of application may be obtained from the Secretary, School of Graduate Studies, and should be returned with a statement of qualifications not later than March 1st. The first award was available in 1943.

THE C.I.L. FELLOWSHIP IN CHEMISTRY

This Fellowship, the gift of Canadian Industries Limited, of the value of $750 is established for the encouragement of post-graduate work in Chemistry. It is open to any British subject who is a graduate of a recognized University. The holder of this Fellowship will be required to undertake research in any branch of Chemistry under the direction of the department designated by the Committee of Award. Application must be made, with full statement of qualifications and testimonials, to the Secretary of the School of Graduate Studies not later than March 1st.

T. A. RUSSELL MEMORIAL RESEARCH FELLOWSHIP

The T. A. Russell Memorial Research Fellowship in Physical Metallurgy, of the maximum value of $1,000, in the Faculty of Applied Science and Engineering will be awarded to a student registered in the School of Graduate Studies who undertakes advanced work in the field of physical metallurgy. Applications must be made to the Secretary, School of Graduate Studies.

THE GARNET W. MCKEE-LACHLAN GILCHRIST GEOPHYSICS SCHOLARSHIPS

Financial assistance was received by Professor Lachlan Gilchrist of the Departments of Physics, University of Toronto, from certain organizations and individuals to help him in the prosecution of his research work in Geophysics. With the consent of the contributors, the unexpended balance of these gifts was transferred by Professor Gilchrist to the Board of Governors of the University to be used as an endowment for scholarships, two of which were established in the Faculty of Applied Science and Engineering. To this fund have been added additional amounts received from the estate of the late Garnet W. McKee and from the Hollinger Consolidated Gold Mines Ltd. They are awarded by the Senate, on the recommendation of the Council of the Faculty of Applied Science and Engineering. The first awards were made on the results of the Annual Examinations of 1941.

The First Garnet W. McKee-Lachlan Gilchrist Geophysics Scholarship. This scholarship, of the annual value of the income from $4,000.00, is awarded to the student in the Second Year in the Course in Engineering Physics who obtains the highest aggregate standing at the examinations of the First and Second Years in the Course, provided always that the student obtains honour standing at the examinations of the Second Year.

The Second Garnet W. McKee-Lachlan Gilchrist Geophysics Scholarship. This scholarship, of the annual value of the income from $3,000.00, is awarded to the student in the Second Year in the Course in Engineering Physics who, of those students who elect to proceed in the Third Year in the Geophysics Option of the Course, obtains the highest aggregate standing at the examinations of the First and Second Years, provided always that the student obtains honour standing at the examinations of the Second Year, and excluding always the student to whom the First Lachlan Gilchrist Geophysics Scholarship has been awarded.

If in any year there is no student who has fulfilled the conditions as laid down for the Second Lachlan Gilchrist Geophysics Scholarship, it shall be awarded to the student in the Second Year in the Course in Engineering Physics who obtains the second highest aggregate standing at the examinations of the First and Second Years of that Course, provided always that such student obtains honour standing in the examinations of the Second Year.

THE W. G. MILLAR MEMORIAL SCHOLARSHIP

The W. G. Millar Memorial Scholarship is presented by Irish and Maulson, Limited, of an annual value of $250.00, in memory of the late Mr. W. G. Millar, a member of the Class of 1914 in Civil Engineering. The Scholarship will be awarded to a student entering the Third Year in Mining Engineering, on the recommendation of the Head of the Department of Mining Engineering. If deemed advisable the award may be divided.

The award will be made on the following basis:

(a) In addition to mental capacity, the student must show leadership ability and give promise, through his activities, of becoming a worthwhile influence in the affairs of the profession and the community.

(b) While attention is given to scholastic ability, as evidenced by his acedamic standing, it is not the governing factor. He must, however, stand in the top quarter of his class.

(c) Special consideration is given to financial need.

Application must be made to the Secretary of the Faculty within one month of the opening of the academic year.

CONSOLIDATED MINING AND SMELTING COMPANY OF CANADA, LIMITED, RESEARCH FELLOWSHIP

The Consolidated Mining and Smelting Company of Canada, Limited, offers annually a Research Fellowship in the School of Graduate Studies of $750.00 for a research related to non-ferrous metals, heavy chemicals, and fertilizers. The Fellowship is known as the "Cominco Research Fellowship."

It is open to graduates in Science, Engineering, or Agriculture of a recognized university and preferably a British subject resident in Canada.

Applications for the Fellowship must be made to the Secretary of the School of Graduate Studies, not later than September 1.

CANADIAN INSTITUTE OF STEEL CONSTRUCTION RESEARCH FELLOWSHIP

This fellowship, donated by the Canadian Institute of Steel Construction, is offered to encourage scientific research in steel construction. It is open to honour graduates in engineering of any recognized university. The holder of the fellowship must be registered in the School of Graduate Studies as a student proceeding to a post-graduate degree and must carry out a programme of study and research prescribed by the School of Graduate Studies. The annual value of the fellowship is not less than $750 for a seven months term and not more than $1,200 for a ten months term.

Application should be made to the Secretary of the School of Graduate Studies not later than September 1 and should be accompanied by an official transcript of the applicant's undergraduate record, together with a statement of his engineering experience.

CANADIAN LUMBERMEN'S ASSOCIATION TIMBER RESEARCH FELLOWSHIP

This fellowship, donated by the Canadian Lumbermen's Association, is offered to encourage advanced study and research in timber engineering. It is open to graduates in engineering and graduates in forestry of any recognized university. The fellow must be registered in the School of Graduate Studies as a student proceeding to a post-graduate degree and must carry out a prescribed programme of study and research in both engineering and forestry. It is intended that the work of this programme

will extend over a period of two academic years. The annual value of the fellowship is $1,000, all of which might not be granted to one student.

Application should be made to the Secretary of the School of Graduate Studies not later than September 1 and should be accompanied by an official transcript of the applicant's undergraduate record, together with a state- ment of his experience in the forestry and construction fields.

LOAN FUNDS

From the loan funds mentioned below, small loans can be made to students who are in urgent need of assistance. The funds are not large and the loans must accordingly be restricted, both in amount and number, and principally to students in the Third and Fourth Years.

Enquiries for loans from any of the following funds should be made at the office of the Secretary of the Faculty:

Engineering Society Loan Fund
Elizabeth Speller Memorial Fund
James W. Crocker Memorial Fund

ENGINEERING SOCIETY LOAN FUND

In 1932 the Engineering Society repaid to the Board of Governors a series of annual grants which, over a period of years, had been made to the Society for special purposes. The Board of Governors, appreciating this action, set aside this sum, to be known as the Engineering Society Loan Fund, to provide loans to students of the Faculty of Applied Science and Engineering. The administration of the fund is carried out by a Committee appointed by the Board. The fund is not large, and only small loans can be made to relatively few students. Further inquiries should be made at the office of the Secretary of the Faculty.

ELIZABETH SPELLER MEMORIAL FUND

Through the generosity of Dr. F. N. Speller, of the class of 1893, the "Elizabeth Speller Memorial Fund" has been established, the annual income from which is available for loans to worthy students of the Third and Fourth Years of this Faculty. Applications for loans from this Fund should be made to the Secretary of the Faculty.

JAMES W. CROCKER MEMORIAL LOAN FUND

This fund was established by Mrs. William Crocker in memory of her son, James W. Crocker, a graduate in Mining Engineering in 1938, who was killed in an accident in a mine in the same year.

SECTION XII. LIBRARIES AND LABORATORIES

THE UNIVERSITY LIBRARY

The University Library building is situated on the east side of the lawn that lies to the south of University College. It contains reading-rooms for men and for women, a law reading-room, and a medical reading-room, besides departmental studies which may be used as study rooms for honour students in the various departments in which the professors hold seminary courses, and private studies intended for advanced students engaged in research work.

The University Library building is open from 8.45 a.m. to 10 p.m. during the academic term. In the vacation, it is open from 9 a.m. to 4 p.m. (1 p.m. on Saturdays). Books in ordinary use may not be taken out of the Library building or from the reserved book reading-rooms during the day-time, but are lent for the night after 3 p.m., to be returned the following morning not later than 10 o'clock. Books not in general demand may, on application, be borrowed for a longer period.

AJAX DIVISION LIBRARIES

There are two main libraries at Ajax, the Technical Library and the General or Circulating Library.

The Technical Library is located in the Academic area, close to the lecture rooms and laboratories, and contains the books and periodicals recommended in connection with the courses of instruction. It provides facilities for study during working hours; and books may also be borrowed from it for short periods.

The General or Circulating Library is located in the northern area near the residences. It contains a collection of general reference works, and also a wide variety of both educational and recreational reading. Books may be borrowed without time limit, but subject to recall.

Books not available in Ajax may be borrowed from the University Library in Toronto, either through the Technical Library or through the Circulating Library, provided they are not in urgent demand in the University Library.

DEPARTMENTAL LIBRARIES

Periodicals and other literature in the University Library of special interest to the students of this faculty have been housed in the Electrical. Engineering, Mechanical, and Mining Buildings for convenient reference,

These departmental libraries are situated as follows:

Applied Physics..............	Room 22, Engineering Bldg.
Architecture..................	Room 37, Engineering Bldg.
Chemical Engineering........	Room 53½, Mining Bldg.

Civil Engineering............	Room 25, Electrical Bldg.
	Room 22, Engineering Bldg.
Electrical Engineering........	Room 25, Electrical Bldg.
Geology....................	Room 74½, Mining Bldg.
Mechanical Engineering.......	Room 6, Mechanical Bldg.
Metallurgical Engineering.....	Room 37, Mining Bldg.
Mining Engineering..........	Room 314, Mill Bldg.

CIVIL ENGINEERING LABORATORIES

There are four main divisions comprising these laboratories, namely: Cement, Highway, Soil Mechanics, and Mechanics of Materials.

CEMENT LABORATORY

The Cement laboratory contains all the appliances necessary in making the usual physical tests on Portland cement. It is supplied with cabinets and apparatus for individual work and various shot machines designed for tension and transverse tests. In addition, the laboratory is equipped with moulds, knock-down forms for beams, drying ovens, a curing room controlled for temperature and humidity, and other apparatus required in investigating the properties of aggregates and concrete mixtures.

HIGHWAY LABORATORY

The Highway laboratory is equipped to carry out investigations in bituminous and non-bituminous materials used in highway construction and maintenance. Among the more important pieces of apparatus are the Deval abrasion, the Page Impact, and the Dorry Hardness machines, a standard brick rattler, jaw crusher, diamond core drill with rock saw and grinding lap, bituminous extractor, viscosimeters, ductility and penetration machines, cementation test apparatus, electric ovens, constant temperature baths and special equipment for the determination of the properties of subsoils.

SOIL MECHANICS LABORATORY

The Soil Mechanics laboratory is supplied with apparatus designed for the investigation of the physical properties of soils. It contains a mechanical centrifuge for determining moisture equivalents, Dow liquid limit machines, consolidation and shear machines, Proctor compaction test apparatus, a penetration and bearing power machine, sampling tools, dispersing apparatus, hydrometers, etc., and a device for demonstrating the quicksand phenomena, permeameters.

MECHANICS OF MATERIALS LABORATORY

The Mechanics of Materials laboratory is available for the scientific and commercial testing of materials of construction such as iron, steel, timber, concrete, and masonry. The equipment includes a Riehle

400,000-lb. three screw power universal testing machine, with a capacity for beams and girders up to 28 inches in width and 16 feet in span, and for specimens in tension and compression up to 10 feet in length, a Riehle 200,000-lb. screw power universal testing machine, taking beams 18 feet in span, and tension and compression specimens up to 12 feet in length, a Riehle 100,000-lb. screw power universal testing machine, a Riehle 20,000-lb. screw power universal testing machine, an Olsen 20,000-lb. hand-power, wire testing machine, specially fitted for testing wooden columns with both fixed and pivoted ends, an Olsen 20,000-lb. hand-power universal testing machine, especially adapted for testing long columns, an Olsen torsion machine of 140,000 inch-pounds capacity for testing the strength and elasticity of shafts and rods up to 2 inches in diameter and 10 feet in length; a hand-power torsion machine of simple mechanical design for testing short shafts of a maximum diameter of one inch, a Riehle 5,000-lb. transverse load testing machine for flexural tests of bars of wood and metal up to 48 inches in length, an Olsen 200-lb. tension testing machine, designed for the testing of textiles.

There are also special machines, such as an Olsen (Izod) pendulum impact machine; Brinell, scleroscope, and Firth Hardometer for hardness testing; an Avery repeated stress (fatigue) machine of the rotating beam type; proving levers and standard weights, an elastic ring, and an Amsler 60,000-lb. box, for calibrating purposes.

The accessory equipment includes Berry and Olsen strain gauges, a Nalder dividing engine, Beggs deformeter gauges, a Fereday-Palmer stress recorder—an instrument ideally suited for determining stresses in actual structure — apparatus for measuring angular deformation, a strainometer for use in determining Poisson's ratio.

In addition to the above, there are available a large number of strainometers of the usual degree of precision. These include the Bauschinger, Martens, Unwin, Ames, Riehle, Johnson, Huggenberger, De Forest scratch gauge, and other types.

MINING ENGINEERING LABORATORIES

During 1931 the building containing these laboratories was entirely rebuilt and greatly enlarged. The new building is 72 ft. x 100 ft., and is four stories high with a basement under half of it. The top floor and part of the third are occupied by the assaying laboratories. The rest of the building is given up to the ore dressing and mining laboratories, the commodious library and study rooms, lavatory and shower baths, rooms for the staff, two rooms for research in ore dressing, a model and map room, and storerooms.

ASSAYING LABORATORY

The East and West Fire Assay laboratories occupy the top floor of the Mill Building. They are identical, with preparation, furnace, and

balance rooms in sequence, while between and common to these is a supply room, and another for chemical work. This arrangement allows a natural flow of operations from sample preparation to final weighing. Equipment in general is ample to give individual work to 32 students, thus encouraging original effort and conserving time.

The grinding rooms have a Sturtevant 2 x 6 jaw crusher, a McCool 8″ eccentric plate pulverizer, buck-boards, samplers, screens, and cupel machines. A special laboratory sampler gives samples of indisputable similarity, thus confining variations in students' assays, to their work.

Each furnace room has six Fletcher-Russell gas, and two D.F.C. oil furnaces. Parting cabinets have fan exhaust and direct illumination. Each student is allotted a work place equipped with a pulp balance, weights, tools, fluxes, and locker for individual work.

The bead balances are modern instruments by Ainsworth, Becker, Heusser, Keller, Oertling, Thompson, and Voland. Some have special rider devices and a sensitivity of 0.002 milligram. Each has independent lighting and is mounted on a cork insulated pier.

A sample room houses a wide variety of ores, mill products, mattes, bullion, and alloys from typical mines and smelters. Thesis, service, and study rooms on the third floor provide facilities and equipment for student research. Two staff rooms are used for the determinations necessary for instructional purposes and for research. A Hoskins electric furnace with Leeds-Northrup controllers and recorder is installed here. Other equipment includes pyrometers, microscope, electrolytic apparatus, and bullion rolls.

MINING LABORATORY

The Mining laboratory makes use of the ore dressing equipment as required. It is also equipped with an Ingersoll-Rand type ER-1 compressor and a variety of air driven rock drills representing the development of this machine. Blocks of synthetic ore for practising sampling and rock drilling are made up as required. A laboratory has been completed for the study of ventilation problems, air conditioning, dust counts, etc. In the main basement are bins for the accommodation of a large variety of ores from various mining districts.

ORE DRESSING LABORATORY

The main Ore Dressing laboratory, 72 ft. x 53 ft. x 22 ft. high, is equipped with the old five stamp battery with amalgamation plates, Wilfley table, Deister Plato table, Deister slime table, an old-fashioned buddle, and classifiers. Parallel with the stamp mill is a ball mill 30 in. x 24 in., which can be used alternatively with the stamps in connection with the concentrating tables. At one side of this main laboratory is apparatus representing the complete flow-sheet of a modern concentrator designed for continuous operation at the rate of 50 to 100 lb. per hour. This plant consists of feeders, two rod mills and a ball mill each 18 in. x

12 in., with classifiers, two Wilfley tables, a Dorr type thickener, a six-cell Fahrenwald Sub A flotation unit, a conditioner, a small pilot Wilfley table, and a Genter thickener. Another laboratory, 70 ft. x 25 ft., is set aside for batch work, and contains a variety of flotation machines, small ball and rod mills, small jigs, apparatus for cyanide tests and for tests in magnetic concentration. Other rooms are set apart for hand screening, microscopes, balances, a chemical room, and a room for roasting and other high temperature testing of ores in connection with ore dressing. For further research in ore dressing, there are available, Haultain Superpanners and Infrasizers, briquetting apparatus and metal lap machines for the polishing of briquettes in the study of minerals and mill products. The laboratory is also equipped with a Panphot microscope and accessories.

The Crushing laboratory contains a Hadfield gyratory crusher, a set of rolls 16 in. x 12 in., two small Dodge crushers, two sets of miniature rolls, two disc grinders, and a dry screening machine of the Feraris type. Adjoining this room is a large room for practising sampling methods.

MECHANICAL ENGINEERING LABORATORIES

HEAT ENGINE LABORATORY

Instruction in this laboratory covers the examination and testing of steam engines and boilers, and of internal combustion engines of the Diesel and automobile types, as well as stationary power units. Experiments on the octane rating of fuels, heating values of coal, etc., and the action of injectors and heat transmission apparatus are made. On the mechanical side, experiments are made on static and dynamic balancing, belt testing, oil testing, etc.

The part of the building set apart for thermodynamics and mechanical work is the ground floor of a room 60 ft. x 155 ft. This room is lighted entirely from the roof in an efficient way. A part of the space 40 ft. wide running the entire length of 155 feet is served by a 3-ton travelling crane, and contains the following equipment:

50 h.p. Brown engine with separate jackets on both heads and barrel of cylinder.

Two-stage Rand air compressor having compound steam cylinders, each fitted with Meyer cut-off gear. The low pressure air cylinder has Corliss inlet gear.

30 h.p. high-speed Leonard tandem compound engine with shaft governor.

40 h.p. Uniflow engine.

25 h.p. General Electric steam turbine.

Two 15 h.p. Leonard engines with different types of valves, which are used for valve setting, presented by E. Leonard & Sons.

Centrifugal air compressor.

There are also two surface condensers with air pumps so arranged that any engine in the laboratory may be made to exhaust into the atmosphere

through an open heater, or into one of the condensers, the change from one arrangement to the other being accomplished in a few minutes without the aid of valves.

The laboratory further contains:

A 3-ton York refrigerating machine with tanks.

An Amsler transmission dynamometer.

Apparatus for testing injectors and steam pumps.

Hot blast heating equipment.

Experimental air conditioning apparatus.

Numerous other pieces of apparatus and instruments.

The work on internal combustion engines is performed on the following:

14 h.p. National gas engine arranged for various compressions and points of ignition.

25 h.p. horizontal Diesel engine made by Ruston and Hornsby, especially arranged for testing.

25 h.p. Allen semi-Diesel engine.

25 h.p. tractor gasoline engine.

Six cylinder Chevrolet automobile engine. (Presented by the makers.)

200 h.p. Sprague electric dynamometer.

Eight cylinder Ford automobile engine. (Presented by the makers.)

Leyland six cylinder Diesel engine.

Hercules six cylinder engine for various fuels.

Standard C.F.R. fuel rating engine for finding the octane rating of fuels, etc.

Various accessories to above machines.

Steam for the laboratory is supplied by two 50 h.p. and one 100 h.p. Babcock and Wilcox boilers, the latter having an internal superheater. These boilers are located in a separate boiler room. They are used for experimental work only and are fitted up for testing. The gases pass up through two independent chimneys, and these have been arranged so that the draft and other conditions in the chimney at any point of its height may be examined.

In smaller work-rooms off the main laboratory are placed belt and oil-testing machines, and apparatus for testing the efficiency of machines.

A Carwen Olsen balancing machine for static and dynamic balancing has recently been installed.

HYDRAULIC LABORATORY

The Hydraulic laboratory is designed to give practical hydraulic experiments illustrating the laws of flow of fluids in pipes, through orifices, over dams, etc. Friction loss may be measured, and the action of various types of meters, with their coefficients, is examined. Measurements of the efficiency and best methods of operation of pumps, and of turbines of various types, are also determined and problems relating to water power development, also to the movement of fluids, find a place in this laboratory.

The laboratory occupies two floors, each 40 ft. x 112 ft., and the apparatus therein may be briefly listed as follows:

Two 2-stage Gwynne centrifugal pumps, each for one cubic foot per second at 125 feet head.

Two 2-stage Escher Wyss turbine pumps, each for one cubic foot per second at 150 feet head.

These four pumps may be run in parallel for four cubic feet per second at 125 feet head, or in any desired series arrangement giving one cubic foot per second at not over 550 feet head, thus allowing for a wide range of experimental work.

A 125 h.p. Belliss and Morcom engine of 525 r.p.m. for driving the four pumps mentioned, and for experiment if desired.

A motor driven turbine pump for six cubic feet per second at 65 feet head for supplying the turbines.

An open trough five feet wide and 110 feet long for towing models and meters, and for certain types of open channel work.

A small reciprocating experimental pump.

A four stage motor driven turbine pump for experiments.

An Escher Wyss reaction turbine, 13½-inch runner, built specially for the laboratory.

A 24-inch Pelton turbine specially constructed for study.

A 12-inch Doble impulse turbine.

A reaction turbine with both Francis and propeller runners designed for this University.

An experimental centrifugal pump and meters.

A Kaplan turbine also made for test purposes.

A concrete and steel flume built primarily for research work on turbines.

A Moody spiral pump, motor driven, for a delivery of twelve cubic feet per second at low head.

A very carefully designed dynamometer and efficient set-up to enable reliable efficiency tests to be made with great accuracy.

A vertical steel tank 5½ feet diameter and 34 feet high to be used as a reservoir, also for experiments on nozzles, valves, meters, etc.

A weir tank 6 feet wide and 21 feet long with hydraulically operated valves.

Two measuring tanks, each of 240 cubic feet capacity, each mounted on accurate scales and to be used to calibrate the weirs or to weigh large quantities of water.

Three tanks, each 3 feet wide and 12 feet long, for experiments on orifices and weirs.

Six measuring tanks for calibrating the above orifices, etc.

A glass sided trough 30 feet long for studies on weirs, dams, and similar structures.

Venturi meter, hydraulic ram, Pitot tubes, numerous models, gauges, gauge tester, and all apparatus necessary for the above mentioned studies. The laboratory piping has been designed to give wide variety of operation

of the system. Piping has been set up for friction and nozzle experiments and other work.

The laboratory is indebted to the Dominion Engineering Works, Montreal, and to the late Mr. William Inglis and others for generously supplying parts of the apparatus.

CHEMICAL ENGINEERING LABORATORIES

The Chemical laboratories are situated in the Mining Building, and are supplied with the usual modern equipment.

Seven large laboratories, each with its own balance room, and seventeen small laboratories are in steady use. Some of the latter are specially equipped for work in such fields as gas analysis, calorimetry, polarimetry, hydrogen ion investigations, and water analysis. A fireproof room is provided for work with volatile solvents and organic analysis, and special equipment for semi-micro analysis is permanently maintained. Nine of the small laboratories are set apart for undergraduate and graduate research, and a room is set apart for the construction of glass apparatus by the glassblower connected with the department, in which instruction in glassblowing is given to students. One of the large laboratories, approximately forty feet square, is equipped for the experimental study of chemical engineering and industrial chemistry. Among the apparatus installed there are: a stoneware column for the investigation of the absorption of gases by liquids, fractionating still, heat transfer apparatus filter press, vacuum evaporator, sulphonator, fusion pots, autoclaves, jacketed kettle, tanks, pumps, meters, and other necessary accessories. Each of these is used by undergraduates, and is further employed from time to time in research.

ELECTRICAL ENGINEERING LABORATORIES

The Electrical laboratories, located in the Electrical Building, are equipped for studies related to principles discussed in lecture courses rather than for routine tests.

The power services to all laboratories are 230-115 volts, direct current; 115 volts, three phase, 25 cycles; and 115 volts, three phase, 60 cycles. Power for the laboratories is supplied by the University Central Heating and Power Plant in the form of 230-115 volts, three wire, direct current. The alternating current services are supplied from two main motor-generator sets which are equipped with automatic voltage and speed regulators.

These different services, combined with a system of spare conductors, make it possible to conduct a great variety of experiments in any one of the laboratories. In all laboratories the measuring instruments are of the highest quality.

ALTERNATING CURRENT MACHINE LABORATORY

The Alternating Current Machine laboratory, located on the first floor, contains the main 25-cycle and 60-cycle service sets referred to above. For experimental purposes the following equipment is available: two 15 kva. motor generator sets, d.c. to 60-cycle a.c.; two 15 kva. motor generator sets, d.c. to 25-cycle a.c.; two 10 kva. 60-cycle phase displacement dynamometer sets; a 25 h.p. low speed (322 r.p.m.) 60-cycle synchronous machine which produces an emf. wave very close to sine form; a 5 kw. 60-cycle synchronous converter; a mercury-arc rectifier; transformers; a.c. motors of all types; a model transmission line; two electromagnetic and two cathode ray oscillographs; and all necessary auxiliary apparatus.

DIRECT CURRENT MACHINE LABORATORY

The Direct Current Machine laboratory, located on the second floor, has a 40 kw. 230 volts d.c. to 115 volts d.c. motor-generator set with Tirrill regulator for special tests. Other equipment includes a number of 5 to 10 kw. motor-generator sets for d.c. generator tests; shunt, series and compound motors with and without interpoles; and other necessary apparatus such as loading racks, rheostats, circuit breakers, prony brakes and motor starters.

ELECTRICAL MEASUREMENTS LABORATORY

The Electrical Measurements laboratory, located on the top floor, is fitted with a convenient arrangement of power supply including a very flexible storage battery service and a 1,000-cycle service in addition to the standard a.c. and d.c. services. The equipment includes galvanometers, resistance boxes, Wheatstone bridges, shunts, potentiometers, standard cells, bond testers, condensers, and such other apparatus required for making a great variety of studies in measurements by direct and alternating current methods.

COMMUNICATION LABORATORY

The Communication laboratory, located on the top floor, is equipped for setting up and measuring vacuum tube circuits of all usual types; and for measuring the properties of networks at both low and high frequencies. Cathode ray oscillographs, harmonic analyzers, amplifiers for bridge balance, etc., are available. A 1,000-cycle supply of good wave form is located at all measuring points in the laboratory. A separate room is treated acoustically and equipped with the necessary apparatus for the study of electrical reproduction of sound.

SPECIAL LABORATORIES

A few smaller laboratories are set apart for particular studies. These include a high voltage laboratory with a 200,000-volt transformer and a 50,000-volt transformer complete with controls; a room with a specially designed model transmission line for the study of line characteristics, and

a room with a small electric furnace for studies of the effect of temperature on materials from an electrical engineering point of view.

Study rooms are associated with the laboratories for design studies and engineering problems.

METALLURGICAL ENGINEERING LABORATORIES

These laboratories, in the east end of the Mining Building, occupy approximately 3,600 square feet on the basement floor and the same space immediately above on the ground floor. The furnace room contains a motor driven Connersville blower, several gas-fired furnaces, and two small blast furnaces. The larger electric furnaces of the Department of Chemistry (Electrochemistry) are in this room. Some are supplied with direct current, others with alternating current from a 200 K.V.A. transformer. A system of flues, with hoods over all the furnaces, leads to a stack through which gases are pulled by a fan.

The department has recently installed a 50 k.v.a. 60 cycle service which permits the operation of modern experimental equipment. A 7.5 k.v.a. and a 15 k.w. 300,000 cycle high frequency converter (on loan from National Research Council) are available for special melting and heat treatment experiments. A Detroit Rocking Arc Furnace of latest type is now available for the production of ferrous and non-ferrous alloys.

Hydro-metallurgical equipment includes apparatus for leaching and electrolytic precipitation in circulating systems.

Situated in these two rooms, also, is most of the equipment used in the teaching of ceramics and non-metallic industrial materials. The apparatus includes a dry pan, a small dry press, a plunger machine with tile and hollow ware dies, an Abbé six-jar ball mill, a recuperative down draft clay testing furnace of brick construction, a small Seger test furnace, a high temperature oxygen acetylene furnace, a high temperature electric muffle furnace heated by "globars", and standard screens, volumeters, elutriation apparatus, driers, and such sundries as are necessary for clay testing.

The upper floor is divided into laboratories, a library, store rooms, and offices. The laboratories are for metallurgical analysis; heat treatment and pyrometry; grinding, polishing, and etching; metallographic room, with two adjoining dark rooms.

The laboratory for metallurgical analysis is well equipped to give students training in mill and smelter methods, the analysis of ores, furnace products, ferrous and non-ferrous alloys, and specialized ceramic bodies.

In the heat treatment and pyrometry laboratory there are a number of gas and electric furnaces, a Leeds and Northrup micromax potentiometer, a disappearing filament pyrometer, a radiation pyrometer, and thermocouples for use with millivoltmeter or potentiometer.

For grinding and polishing there are provided many sets of emery papers and six motor-driven polishing wheels.

The metallographic room is equipped with a horizontal Bausch & Lomb photomicrographic camera, a Leitz micro-camera attachment, two vertical cameras, and nine metallographic microscopes.

The laboratories also contain a "Tensometer" for making tensile tests, notch bar tests and Brinell tests on small test pieces, a Leeds and Northrup type "K" potentiometer for determining critical points, a Rockwell hardness testing machine, a Shore scleroscope, an emery cutting disc, and a mechanical saw.

The laboratory workshop is equipped with usual machine tools, together with acetylene and arc welding equipment.

APPLIED PHYSICS LABORATORIES

The Applied Physics laboratories, situated in the Engineering Building, are equipped as follows:

The Photometric laboratory is equipped with precision and portable photometers for the measurement of candle-power, illumination, and brightness; integrating spheres for determining the luminous output and efficiency of lamps and luminaires; and colorimeters, spectro-photometers, and flicker photometers for the measurement of colour. Standards of candle power, luminous flux, and colour temperature are maintained and a 132-volt storage battery with all electrical controls and meters necessary for precise photometry are provided.

The Illumination Design laboratory is equipped for demonstrating and measuring the performance of lighting installations.

The Optics laboratory is equipped with optical benches, etc., for the testing of lenses, and with examples of various optical instruments for instruction in their theory and applications.

The Photographic laboratory is equipped with cameras, dark rooms, and accessories for practical work in photography, and with sensitometers, spectrographs, and densitometers for the testing of photographic materials. A Zeiss phototheodolite, stereoscopes, stereocomparator, and plotting apparatus are provided for instruction in photographic surveying.

The Acoustical laboratory is equipped with the ordinary apparatus, such as forks, pipes, strings, etc., for illustrating the elementary laws of acoustics. There are also two rooms for work in sound transmission and absorption, equipped with an audio-frequency oscillator for the production of sounds of constant intensity, and microphones and amplifiers for, reception.

UNIVERSITY SURVEY CAMP

In 1920 the University purchased approximately 175 acres of land comprising a tract of field, woodland, and lake front property in the County of Haliburton, and erected permanent buildings for the use of

students in Civil Engineering, Mining Engineering, Mining Geology, and Architecture, as well as for other students taking special work. The country is broken and rolling, and with the numerous small lakes and streams in the immediate vicinity, is admirably suited for work and the various problems that arise in practical surveying. The camp is at an elevation of about 1,000 feet above sea level and a secondary triangulation has been carried out, the stations of which are connected with the primary stations of the Geodetic Survey of Canada. Permanent bench marks have been established and connected up with the precise level net of Canada.

The Camp may be reached by the Canadian National Railways, via Lindsay to Gelert, where conveyances are always on hand to drive direct to the camp by way of Minden, a distance of 12 miles. There is also a daily bus service from Lindsay to Minden.

The Camp, located 4 miles south of Minden, on the west side of Gull Lake, can be reached by road after leaving the main Provincial highway at Minden. There are four main buildings, including a Dormitory, Administration, Staff, and Dining Hall Building, which are suitably furnished and provided with electric lighting and drafting accommodation. Accommodation for 80 students can be provided, and a large proportion of the equipment of the Department is transported to the Camp for use during the summer session.

The charge for accommodation at the 1947 camp will probably be $1.75 a day.

Mail, telegrams, or telephone messages should be addressed to "University Survey Camp, Minden, Ontario".

METROLOGICAL LABORATORY

The Department of Surveying and Geodesy is provided with all the ordinary field instruments, such as transits, levels, compasses, micrometers, sextants, planimeters, plane tables, tapes, chains, etc., with which is carried on the instruction in practical field operations as detailed elsewhere.

A small laboratory is also established in the basement of the observatory described below, containing the necessary instruments for the refined measurements of geodetic surveying; as, a standard yard and metre, a Rogers 10-foot comparator, an invar base measuring apparatus, a Kater's pendulum with vacuum chamber, a level trier, micrometer microscopes, etc.

The geodetic observatory in connection with this department is used for the instruction of students of the Fourth Year in taking observations for time, latitude, longitude, and azimuth by the precise methods used in connection with a geodetic survey. It contains a 10-inch theodolite and zenith telescope by Troughton & Simms; an astronomical transit instrument and an 8-inch theodolite by Cooke; two electro-chronographs; a Howard astronomical clock; a Dent sideral clock; a Dent sideral break-circuit chronometer; a wireless receiving instrument; arithmometers, etc.

AERODYNAMIC LABORATORY

The Aerodynamic Laboratory is fully equipped with an improved 4-ft. Royal Aircraft Establishment type wind channel, aerodynamic balance, micromanometers and other necessary instruments.

Air speeds of 80 feet per second can be secured in a stream of great steadiness and uniformity and higher speeds with some sacrifice in steadiness.

The work done in the Laboratory includes the investigation of problems in aerodynamics, tests of air craft components, and complete machines, rating of meters, ventilators, radiators, etc., and the study of the effect of wind pressure on structures, chimneys, etc.

ONTARIO DEPARTMENT OF HEALTH LABORATORY

Through the courtesy of the Provincial Department of Health, the facilities of the well-equipped experimental laboratory, which the Department operates at Stanley Park (807 Richmond Street West), have been placed at the service of the University for the investigation of problems associated with all phases of Sanitary Engineering. Equipment and means are available for study and research in the various processes employed in sewage treatment, the different methods of water treatment, and the bacteriological and chemical examinations on water, sewage, air, milk, and all factors in sanitation.

ELECTROCHEMICAL LABORATORIES

The Electrochemical laboratories, which are situated in the Mining Building, are provided with special facilities for electrolytic work, including a large storage battery and electroplating dynamo with tanks, as well as a set of apparatus and electrical measuring instruments, for both undergraduate work and research. The experimental work on electric furnaces is carried out in a large furnace room in the basement, occupied jointly by the Department of Metallurgical Engineering and the Department of Chemistry (Electrochemistry). The equipment for this purpose comprises a 120 kw., 220 volt supply of direct current from the main power house through a switchboard, rheostats, circuit-breaker, and instruments to a set of distributing bus-bars, and a 200 k.v.a. transformer stepping down from 2,200 volts to 30-120 volts in 3 and 6 volt steps, which supplies alternating current at 25 cycles. There is a complete set of A.C. instruments, circuit-breakers, oil-switches, relays, automatic regulating winches, etc., and a Northrup high frequency furnace with its transformer is also installed. The two departments co-operate in the use of a Hoskin carbon plate furnace and a resistor tunnel furnace. Facilities for the study of high current carbon arcs and the thermal behaviour of refractories are also provided.

GEOLOGICAL LABORATORIES

The Geological laboratories are equipped for the study of geology from the modern viewpoint. Collections of rocks and minerals, models and natural specimens illustrating various geological features, topographic and geological maps for exercises in map reading, and fossils are all employed in the study of general geology. Typical index fossils are utilized, along with geological maps, in historical geology.

In the Economic Geology laboratory, numerous suites of specimens of ores and rocks illustrate the nature and occurrence of the deposits in many mining camps. A set of building stones, uncut, cut, and polished, is available for a course on that subject. These materials are studied megascopically and microscopically to determine the character and associations of their mineral constituents. The Metamorphic Geology laboratory is supplied with specimens, thin sections, and petrographic microscopes for the study of metamorphic minerals and the changes that rocks undergo in thermal and dynamic metamorphism. Hand specimens and thin sections of suites of rocks from numerous Precambrian areas are also available for work in Precambrian geology. Facilities are available for sawing and polishing specimens of ores, and rocks, and for making thin sections.

For work in structural geology, natural specimens and geological maps exhibiting complex structural conditions and structural problems illustrated by diagrams and drill logs, are extensively employed. For field methods in geology, the laboratories are supplied with geological and topographic maps, survey instruments, and various other equipment, so that work in the laboratory may supplement that in the field.

MINERALOGICAL LABORATORIES

The Mineralogical laboratories in the Mining Building provide facilities for most types of investigation involving minerals, crystals, and rocks.

Courses in laboratory work in the personal examination of type sets of named minerals, crystals, and rocks serve to illustrate the introductory lectures. More advanced work is provided in the identification of unknown minerals by physical tests, blowpipe, and other methods.

To encourage the study of pure crystallography, the laboratories are supplied with goniometers of the various types, crystal models, appliances for the cutting of oriented crystal sections and for their physical examination. Practical petrography is carried on in rooms provided with type sets of rocks, both macroscopic and microscopic. Advanced students are taught to make thin sections of rocks and polished section of opaque minerals, and to study them microscopically.

The laboratory for the preparation of thin sections of rocks and minerals is provided with electric diamond saws and grinding appliances for the various types of work incidental to the preparation of thin sections. It is also equipped for the preparation of polished specimens for the microscopic examination of the opaque ore minerals.

The department is equipped with petrological and mineralographical microscopes, so that it is possible to provide advanced students with instruments and sets of thin sections and polished minerals for their own special use. Sets of index liquids and a universal stage are available for students interested in more advanced methods for determining the optical properties of crystals.

A well equipped X-ray laboratory, with suitable goniometers for the study of crystal structure, is available to qualified advanced students.

MUSEUM

The ROYAL ONTARIO MUSEUM, with exhibits in Archaeology, Geology and Mineralogy, Palaeontology and Zoology, is situated at the southwest corner of Bloor Street and Queen's Park.

Students of the University in all departments are recommended to avail themselves of the privileges of the Museum, which, although under separate control, is intimately connected with the work of the University.

The museum is open on Sunday from 2 p.m. to 5 p.m., and on week days from 10 a.m. to 5 p.m. with the exception of Monday when it is closed all day. The admission is free for the public on Tuesday, Thursday, Saturday and Sunday. On other days an admission fee of fifteen cents is charged.

By a resolution of the Board of Trustees all regular students of the University may be admitted free on showing their registration cards.

DISCIPLINE

1. (*a*) There is vested in the Council of each federated university or college, and of each faculty, disciplinary jurisdiction over and entire responsibility for the conduct of their students in respect of all matters arising or occurring in or upon their respective buildings and grounds including residences.

(*b*) Disciplinary jurisdiction in all other cases as respects all students is vested in the Caput.

(*c*) The Students' Administrative Council, in the discharge of all duties entrusted to it, will be supported in the due discharge of those duties by the disciplinary power of the Caput.

2. No student will be allowed to continue in attendance, whose presence is deemed by the Council of his college or faculty to be prejudicial to the interests of the University. The continuance of any student in attendance at a course in the University or the receipt by him of official certificates of standing or of graduation, is subject to such exercise of the disciplinary power of the Caput as may be necessary to enforce the regulations of the University and to maintain standards of personal conduct acceptable to the University. In the exercise of its disciplinary power, in the interest both of the University and of the student, the Caput will take into consideration the conduct of the student both inside and outside the University premises. In all cases an appeal to the Board of Governors may be made.

3. Students proceeding regularly to a degree are required to attend the courses of instruction and the examinations in all subjects prescribed for students of their respective standing, and no student will be permitted to remain in the University who persistently neglects academic work.

4. All interference on the part of any student with the personal liberty of another by arresting him, or summoning him to appear before any tribunal of students, or otherwise subjecting him to any indignity or personal violence, is forbidden by the Caput and by the Councils of the colleges and faculties.

5. No initiation ceremony involving personal violence, personal indignity, interference with personal liberty, or destruction of property, may be held by the students of any college or faculty of the University, under the penalty of suspension or expulsion.

6. Any reception of the students of the first year in any college or faculty must be approved by the Council of that college or faculty, but such reception must not involve any infraction of the regulations of the two preceding paragraphs.

7. The organizing of a parade in the streets of the city, or the taking part in such parade without the permission of the authorities of the city

on application of the Students' Administrative Council, will be regarded as a breach of discipline.

8. A student who is under suspension, or who has been expelled from a college or faculty or from the University, will not be admitted to the University buildings or grounds.

9. The constitution of every society or association of students in the Faculty of Applied Science and Engineering, and all amendments to any such constitution, must be submitted to and approved by the Council of the Faculty. All programs of such societies or associations must, before publication, receive the sanction of the Council. Permission to invite any person not a member of a faculty of the University to preside at or address a meeting of any such society or association must be similarly obtained.

10. The name of the University is not to be used in connection with a publication of any kind without the permission of the Caput.

11. Students of any faculty or college on the premises of colleges or faculties other than those in which they are registered shall be subject to the regulations and penalties imposed by the administrative authorities of the premises concerned.

UNIVERSITY HEALTH SERVICE

The University Health Service is the official students' health service and its facilities and services are available to any student on payment of the annual fee of $5.00. This fee is compulsory for all students except (*a*) women living in residence at Victoria College, for whom the College provides its own health service; (*b*) students in the following courses:—Pass Course for Teachers, courses leading to the degrees of Bachelor of Science in Medicine and Dentistry and Bachelor of Pedagogy, certain graduate and occasional students and students in the School of Law and the Faculty of Music. Those for whom the fee is not compulsory may enjoy the privileges of the Service on payment of the fee, provided this is done at the time of registration.

Ex-service personnel who are not in courses in which the Health Service fee is obligatory may enjoy the privileges of the service by requesting the Bursar to ask the Department of Veterans Affairs to pay this fee. All are strongly advised to do this, as by special arrangement with the Department of Veterans Affairs the Health Service has agreed to act as a preliminary screening clinic: (*a*) treating as out-patients minor ailments; (*b*) hospitalizing in university infirmaries minor illness requiring such treatment; (*c*) referring by appointment to the Christie Street Hospital out-patients clinics cases requiring consultation or specialist treatment and (*d*) clearing major cases requiring hospitalization to Christie Street Hospital. In this manner, treatment and liaison with the Department of Veterans Affairs may be greatly facilitated and much time saved.

Undergraduate students, for whom the fee is compulsory, must take an annual health examination conducted by the University Health Service. This examination includes an X-ray film of the chest in the first and final years and in such other years as it may be considered necessary. Owing to the increased possibility of exposure to tuberculosis of students in the Faculty of Medicine their examination includes an X-ray of the chest each year. Should the findings at the initial examination reveal any condition which in the opinion of the Director requires the advice of a specialist, the student will be examined by a consultant. Should the examination disclose evidence of a condition for which medical treatment is indicated, the student will be advised to consult his family physician or other doctor of his own choice. Such a student will be required to report back to the Health Service at stated intervals during the session in order that the Health Service may know that the student has acted on the advice given him. Should any postural defect or other condition arrangements for them will be made with the Director of Physical Education. Should the examination reveal any physical or other defect which, in the opinion of the Director, renders it inadvisable for the student to pursue his course of study, he will be so informed and a report on his

case will be sent to the college, faculty or school concerned. The examination will also determine whether or not the physical condition of the student is such that he may participate in athletics or attend the required physical training classes. By order of the Board of Governors, all students respective of college or year must have a medical examination by the Health Service before taking part in any university athletic activity. Students of the First Year and those proposing to engage in athletic activities must therefore make early appointments for their examinations.

Health Service examinations commence immediately after Labour Day in September. The examinations are by appointment only. The importance of keeping and of being on time for the appointment, as made, cannot be over-emphasized. Appointments for all faculties except Arts are made through the Class President who should contact the Health Service as soon as possible for blocks of appointments. Arts students and members of the other faculties who cannot conform to the times arranged through their Class Presidents may contact the Health Service direct. First Year students and those proposing to engage in athletic activities will be examined first and the examinations should be completed before October 15th. The remaining years are done in succession, examinations being completed early in March. Appointments for X-ray examinations of the chest are made, if possible, when the student reports for his health examination or through the Class President, or by direct contact with the Health Service. The *Varsity* should be carefully watched for notices relative to all appointments.

Any student may consult the University Health Service for medical advice between the hours of 9 a.m. and 5 p.m. daily. (Saturdays 9 a.m. to 12 noon). While the Health Service does not maintain a visiting service, an initial visit for advice and disposal will be made to any student who is taken ill in lodgings or in a residence and who has not a private physician. A nominal charge of $1.00 during the day (9 a.m. to 6 p.m.) and $2.00 at night (6 p.m. to 9 a.m.) will be made for this visit. These charges are payable to the University Bursar by the student, or by the Department of Veterans Affairs in the case of ex-service personnel. Any student who is taken ill or injured on the University grounds or premises will be given essential first aid treatment or advice. Further treatment is the responsibility of the student and must be arranged for privately.

While the University does not admit any legal responsibility for injuries sustained by students, the University Health Service has found it possible to provide for a measure of financial assistance towards the care of students injured while engaged in the required physical training classes or in recognized athletic activities on the campus. Such assistance is available only to students who pay the Health Service fee and who have satisfied the requirements of the Athletic Directorate in regard to athletic eligibility, and will be provided solely on the authorization of the Director. The Health Service will not meet the expense of treatment for which

official arrangements have not been made with the Director prior to the end of the academic term in which the athletic injury occurred. Students who secure unauthorized service do so on their own responsibility. In any case involving questions of eligibility, medical and surgical fees, hospitalization, etc., the decision of the Director is final.

The University Health Service has in operation an Infirmary for Men, situated on the third floor of the west wing of Hart House, and an Infirmary for Women established through the co-operation of University College in connection with the University College Women's Infirmary in the Women's Union, 79 St. George Street. Graduate nurses are in charge of both infirmaries and medical supervision is provided by the Health Service staff. These infirmaries are intended for students with minor illnesses requiring bed care for a period of a few days to a week and are primarily for students in residence or lodgings for whom such care is not otherwise readily available. They are not intended for serious illness or injury requiring hospitalization for longer periods nor for students living at home where bed care is available. Students will be admitted to the infirmaries on the authorization of the Director or Assistant-Director of the Health Service. While in the infirmary, a charge of $1.50 per day, payable to the University Bursar, will be made to cover the cost of meals and routine medication and medical supervision. In the case of ex-service personnel this charge will be paid by the Department of Veterans Affairs.

The University Health Service provides lectures on subjects related to the promotion and maintenance of health.

The men's Health Service is located at 43 St. George Street and the women's at 44 Hoskin Avenue. First aid in the event of sudden illness or accident is available and physicians are on duty or on call as follows:

Monday to Friday, 9 a.m. to 5 p.m.; Saturday, 9 a.m. to 12 noon.

Men—43 St. George Street, MIdway 9644.

Women—44 Hoskin Avenue, MIdway 2646.

Athletic Injuries (*Men*)—A clinic for athletic injuries with a surgeon and first aid attendant in charge is maintained in the West Wing of Hart House between the hours of 5 p.m. and 6:30 p.m., Monday to Friday only. All athletic injuries (men) should be directed here if possible. Telephone MIdway 5838 and ask for Hart House Surgery. Accidents which occur at other than the above times or are of a sufficiently serious nature as to require immediate hospital attendance should be taken: men to the Emergency Department of the Toronto General Hospital; women to the Emergency Department of Women's College Hospital, 76 Grenville Street. To obtain a physician at night or at hours other than noted above for men or women, call MIdway 5838. If there is no answer, call KIngsdale 4141 and ask for the University Health Service physician.

UNIVERSITY HEALTH SERVICE, AJAX DIVISION

All rules, regulations and services as outlined above for the University Health Service, will apply to Ajax Division of the University Health Service.

The Ajax Division of the University Health Service is located in the University Hospital on King's Road in the northern area of the Ajax grounds.

The Hospital is fully equipped to handle all emergencies and arrange for their transfer, if indicated, to a general hospital in Toronto or the near by communities. An ambulance is available at the Hospital at all times. There is adequate bed space to care for minor accidents and illnesses. The Hospital is equipped with a small surgery, laboratory facilities, X-ray equipment and isolation wards. Graduate nurses are in charge and medical supervision is provided by the Health Service physicians. Admission to the Hospital is on the authority of a staff physician of the Health Service.

First aid in the event of sudden illness or accidents available at all times by telephoning the hospital, where a physician is on duty or call.

PHYSICAL TRAINING

By order of the Board of Governors, each man proceeding to a bachelor's degree must take physical training during the first and second years of his attendance at the University. The physical training requirements include a swimming test which must be taken by all first year men, by men admitted to the second year from other universities, and by those repeating the first year. Before October 15th all first year students must make arrangements for a medical examination by the University Health Service at 43 St. George Street. All men required to take physical training must register with the Athletic Association in Hart House before October 15th. Men of second and higher years who wish to take part in any form of atheltics or physical training must first undergo a medical examination by the Health Service.

For the current session the Board of Governors has ruled that ex-servicemen will participate in the required physical training programme on a voluntary basis.

By order of the Board of Governors each woman proceeding to a Bachelor's degree must take Physical Training during the first year of her attendance at the university. Before October 10 in the session in which Physical Training is compulsory she must register for Physical Training at the gymnasium office, 153 Bloor Street West, and before October 15th apply for a medical examination by the University Health Service at 44 Hoskin Avenue. Swimming classes are compulsory for all students who do not pass the required swimming test. Students of all years who wish to take part in any form of athletics or physical exercise must first undergo a medical examination by the Health Service.

The student who has failed to complete satisfactorily attendance at the classes in Physical Training prescribed for the first year will not be permitted to register in the third year: and the student who has failed to complete satisfactorily attendance at the classes in Physical Training prescribed for the second year will not be permitted to register in the fourth year.

The student who has neglected to complete satisfactorily attendance at the classes in Physical Training of the first or second year must take this work during the second or third year respectively of his attendance at the University, and will be required to pay an additional supplemental fee of $10.00.

SECTION XV. HART HOUSE

Hart House, the gift of the Massey Foundation, is so called in memory of Mr. Hart Massey. This House, which is for the use of men only, is far more than a students' club. In its widest interpretation it seeks to provide for all the activities in the undergraduate's life apart from the actual work in the lecture room.

Hart House contains under one roof a dining hall, a tuck shop, and large lunch room, common-rooms, library, debates room, music room, a small chapel together with rooms for the use of the Student Christian Movement, an art gallery, an arts and crafts room, photographic rooms, a chess room, gymnasia, swimming pool, running track, rifle range, and theatre.

The House is open from 8 a.m. to 11 p.m. daily and meals are served to students in the Great Hall. Members are entitled to full privileges of all rooms in the building between these hours and the use of the gymnasia, pool, showers and locker rooms until 9 p.m. each day except Saturday and Sunday, subject to the regulations of the Athletic Association. On Saturday the pool, together with the rest of the athletic wing, closes at 5 p.m.

The Warden is entrusted with the general supervision of the whole House, but the athletic wing is under the direct control of the Athletic Directorate. In great measure the care of the House and its welfare are entrusted to the students themselves. There are a number of committees, most of which consist of ten undergraduates, three senior members, and the Warden. The undergraduates on all these committees are elected annually by the undergraduate members of Hart House. The undergraduate secretaries of seven of these (House, Library, Music, Art, Camera, Debates, and Squash) together with certain appointed representatives, sit on the Board of Stewards (the governing board of the House) which is directly responsible to the Governors of the University. Of this Board the Warden is ex-officio chairman. The Comptroller, the Assistant Comptroller, the Graduate Secretary, and the Assistant to the Warden are responsible for the administration.

All men undergraduates proceeding to a degree in the University are members of Hart House. The annual fee (September to May) is $12.00. To prevent the use of the building by unauthorized persons every member should carry his registration card and show it on request. Any member wishing to introduce a guest should obtain a card from the Warden's office.

Occasional students are not ordinarily eligible for membership in Hart House, but may make application to the Warden's office for election by the Membership Committee.

Graduate students, graduates resident in Toronto, and out of town graduates are entitled to the full privileges of Hart House when they have been duly elected and have paid the annual fee.

HART HOUSE THEATRE

Hart House Theatre is a repertory theatre existing to promote the interests of dramatic art in the widest sense. Its performances are open to members of the University and to the general public. The theatre is operated by a Board of Syndics, who are responsible to the Governors of the University for its administration. It is the policy of the Syndics to permit the rental of the theatre by those recognized dramatic societies within and outside the University which are endeavouring to do serious work.

On December 31st, 1942, owing to war conditions, the theatre was closed for all performances, though it was opened for a few weeks in the early winter of 1944 and 1945 for University dramatic organizations. Plans are being made to open the theatre on a full-time basis as soon as circumstances permit.

THE SOLDIERS' TOWER

To commemorate the sacrifice of those graduates and undergraduates of our University who gave their lives in the Great War (1914-1918), the graduates have erected the Soldiers' Tower. Situated at the southwest corner of Hart House, the Tower rises—a symbol of sacrifice—and with its screen forms a majestic link between Hart House and the old Main Building. Beneath the sheltering arches of the screen, the names of the six hundred and eighteen, to whom the memorial pays its proud and affectionate tribute, are cut deep in the stone. Above, in the belfry of the Tower, is a carillon that, as it chimes, weaves a fabric of memories for professors and students who take up the tasks laid down by those who fell.

HART HOUSE AJAX

Like its namesake, Hart House Ajax seeks to provide for the many activities in the undergraduate's life which lie outside the lecture room and laboratory. The main building (situated south of York Hall) contains a large common room, chapel, library, music room and a shop where snacks are available. In three other buildings in close proximity to the student residences, there are facilities for drama, a camera club, motion pictures, dancing, five-pin bowling, and billiards. From this, it will be observed that Hart House Ajax is not one building, but really a collection of buildings in which every effort is made to embody the Hart House idea.

The small chapel, which is available for use by all members, is under the direction of an ex-service chaplain whose room is adjacent to the chapel. The library, which is for leisure reading, contains a wide selection of books of general interest. The books in this room must not be removed Those wishing to take books to their rooms are referred to the circulating library maintained by the University for Ajax students. A musical programme, similar, as far as circumstances permit, to that sponsored

by Hart House in Toronto, will be provided at Ajax. This programme includes informal recitals, and sing-songs at the noon-hour, Friday afternoon recitals, Sunday Evening Concerts and a Glee Club. While physical limitations do not permit the maintenance of an art gallery, there will be frequent exhibitions of pictures and prints displayed on the walls of the common-room. Camera Club rooms, provided with all the necessary equipment, will be available for members of Hart House Ajax on payment of a fee to cover the expense of chemicals, together with a deposit for door and locker keys.

All the undergraduates enrolled in the Ajax Division are members of Hart House Ajax. Through the courtesy of the Board of Stewards, male members of Hart House Ajax are invited to make full use of the facilities of Hart House when in Toronto.

The Supervisor of Hart House Ajax is responsible for its general supervision but in great measure the care of Hart House Ajax and its welfare are entrusted to the students themselves through the various Hart House Ajax committees. These committees are comprised mainly of undergraduates who are elected by the undergraduate members, together with two or three senior members. The administrative staff of Hart House Ajax consists of Mr. D. L. Emond, Supervisor; Mr. D. S. Claringbold, Assistant to the Supervisor; and Mr. H. V. Brock, Assistant in the Supervisor's Office.

SECTION XVI. STUDENT ORGANIZATIONS

STUDENTS' ADMINISTRATIVE COUNCIL

The Students' Administrative Council is composed of the Presidents or elected heads of the official undergraduate organizations of each college and faculty of the university, including Ajax. The Students' Administrative Council publishes *The Varsity, Torontonensis* and the *Students' Handbook.* It represents the students at university functions and on public occasions and receives and administers all funds accruing from Students' Council fees, revenues from publications, and such other funds as shall become the property of the Council, and through its Secretaries it organizes such intercollegiate and university activities as may be of interest to the student body as a whole.

The Council operates an employment bureau for men and women undergraduates for summer, Christmas and part-time work. It operates a housing service for men and women undergraduates and a loan fund for men and women undergraduates in the final two years of their courses. Application for loans must be made to the General Secretary-Treasurer. of the Students' Administrative Council. The maximum loan is $100.00. A short-term emergency loan fund is available to ex-service personnel pending receipt of maintenance grants or war service gratuities.

The sale of official university jewellery, crests, and so forth, and orders for official blazers are looked after by the Council.

The Council office is located in Hart House, the Women's Office is located in room 82, University College, and a Students' Council office is maintained at Ajax, located in Ajax Hart House, which provides all Council services for Ajax students. The annual fee paid by all undergraduates proceeding to a degree provides for a subscription to the publications of the Council to which the student is entitled and makes available to them all the services of the Council, including the loan fund. The fee also covers the administration costs of the Students' Administrative Council.

UNIVERSITY OF TORONTO ATHLETIC ASSOCIATION

By the authority of the Board of Governors University athletics for men are under the control of the University of Toronto Athletic Association of which the executive body is the Athletic Directorate consisting of:

- the President of the University,
- two members of the faculty, appointed by the President,
- two graduates, appointed by the Athletic Advisory Board,
- the Director of University Health Service, the Athletic Director and the Financial Secretary (*ex-officio*),
- five undergraduates, elected annually, from the student body,
- an undergraduate representative, appointed by the Men Students' Administrative Council.

The Directorate, subject to the approval of the President, is empowered by the Board of Governors to control and administer the compulsory Physical Training programme required by the Board of all men undergraduates during the first and second years of their attendance. The Directorate shall also control and administer the voluntary programme in Athletics and Physical Training available to men undergraduates of all years.

The Directorate alone has the power to sanction the use of the name "The University of Toronto" in connection with men's athletics, and no men's athletic event can be held in the University without its approval. It has full control and direction of the gymnasium, the swimming pool, the locker rooms, showers and other conveniences in connection with athletics in Hart House, the athletic fields, stadium and ice arena.

Subject to certain limitations, the annual athletic fee which is included in the incidental fees, provides for the opening of the gymnasium and swimming pool at nights, permits each student to attend home games of the University football and hockey teams, and offers other privileges such as skating at the outdoor rink and affiliation with golf, riding and ski-ing clubs, etc.

The Supervisor of Athletics and Recreation, Ajax Division, subject to the approval of the Athletic Directorate, is empowered to establish and administer a fully developed programme of athletic activities for students attending the Ajax Division.

The annual athletic fee which is included in the incidental fees provides the same privileges for Ajax students as is available to students on the Toronto campus, subject to the limitations imposed as a result of inadequate facilities.

UNIVERSITY OF TORONTO WOMEN'S ATHLETIC ASSOCIATION

By the authority of the Board of Governors University athletics for women are under the control of the University of Toronto Women's Athletic Association of which the executive body is the Women's Athletic Directorate consisting of:

- the President of the University,
- two women members of the faculty, appointed by the President,
- two women graduates, elected by the Women's Athletic Advisory Board,
- the Assistant Director of University Health Service in charge of Women, the Physical Director for Women, and the Financial Secretary (*ex-officio*),
- five women undergraduates, elected annually,
- one woman undergraduate, appointed by the Students' Administrative Council.

The Directorate, subject to the approval of the President and the Physical Director for Women, is empowered by the Board of Governors

to control and administer the compulsory Physical Training programme required by the Board of certain women undergraduates during the first year of their attendance. The Directorate shall also control and administer the voluntary programme in Athletics and Physical Training available to women undergraduates of all years.

The Directorate alone has the power to sanction the use of the name "The University of Toronto" in connection with women's athletics, and no athletic event for women may be held in the University without its approval.

Subject to certain limitations, the annual athletic fee which is included in the incidental fees, permits each student to attend home games of the University football and hockey teams, and offers other privileges such as skating at the outdoor rink and affiliation with golf, riding and ski-ing clubs, etc.

UNIVERSITY OF TORONTO ENGINEERING SOCIETY

The Engineering Society of the University of Toronto, being inaugurated in 1885, is the oldest undergraduate Engineering Society in Canada. Every student enrolled in the Faculty of Applied Science and Engineering is a member.

As set forth in its Constitution the objectives of the Engineering Society are:

(*a*) The encouragement of original research in Engineering.

(*b*) The preservation of the results of such research.

(*c*) The dissemination of these results among its members.

(*d*) The cultivation of the spirit of mutual assistance and cooperation among the members of the Society in the preparation for, and in the practice of, the Profession of Engineering.

(*e*) To afford an official means of communication between the student-body and the Faculty Council, the University authorities, and the students of other Faculties.

The Engineering Society consists for purposes of organization of a Federation of Clubs which may be listed as follows:

(*a*) The Civil Club of the Engineering Society, composed of the undergraduates in Civil Engineering.

(*b*) The Mining and Metallurgical Club of the Engineering Society, composed of the undergraduates in Mining Engineering, Metallurgical Engineering and Mining Geology.

(*c*) The Mechanical Club of the Engineering Society, composed of the undergraduates in Mechanical Engineering.

(*d*) The Electrical Club of the Engineering Society, composed of the undergraduates in Electrical Engineering.

(*e*) The Architectural Club of the Engineering Society, composed of the undergraduates in Architecture.

(*f*) The Industrial Chemical Club of the Engineering Society composed of the undergraduates in Chemical Engineering.

(*g*) The Engineering Physics Club of the Engineering Society, composed of the undergraduates in Engineering Physics.

(*h*) The Aeronautical Club of the Engineering Society, composed of the undergraduates in Aeronautical Engineering.

(*i*) The Engineering and Business Club of the Engineering Society, composed of the undergraduates in Engineering and Business.

(*j*) The Debating Club of the Engineering Society, composed of the undergraduates in all departments.

These clubs devote themselves to subjects of special interest to their members. Each club holds meetings at regular intervals when papers are read and discussions of a technical nature take place. The club members have the privilege of listening to prominent men in their field and also making frequent field trips to industrial plants.

"Transactions and Year Book" is the official Society publication covering the year's activities. The "Toike Oike Quarterly" is the literary publication of the Society.

The Society also maintains a Supply Department which carries all student supplies with the exception of text books. Profits from the store are used to subsidize the Engineering Society's social functions.

FACULTY OF APPLIED SCIENCE ATHLETIC ASSOCIATION

Affiliated with the Engineering Society is the Faculty of Applied Science Athletic Association.

The Athletic Association has full control over all athletic clubs using the name of the Faculty of Applied Science. The Executive Committee has power to suspend anyone from the privileges of membership in the Association for any breach of its regulations, and controls the finances of all athletic clubs in the aforesaid Faculty. The annual membership fee of this Association is two dollars.

No other moneys are collected for the support of athletics in the Faculty of Applied Science without the sanction of the Executive Committee.

STUDENT CHRISTIAN MOVEMENT

The Student Christian Movement in the University of Toronto is part of an international fellowship of students in the colleges and universities of the world, the World's Student Christian Federation. Based on the conviction that in Jesus Christ are to be found the supreme revelation of God and the means to the full realization of life, the Movement seeks through a programme of study, prayer and practice to understand the Christian faith and to live the Christian life by uniting in its fellowship all students who share its basic convictions as well as those who wish to test their truth.

Among the methods employed by the Movement in seeking to realize its purpose are study groups, worship services, forum discussions, conferences, lectures, work projects, and social services. Of special interest to Engineering students are the "Student-in-Industry" camps which are carried on during the summer vacation periods in industrial communities.

The programme is open to all interested students. It is not necessary to "join" in order to share in the activities of the Movement. On the Toronto campus full information may be obtained from S.C.M. executive members in the various colleges, the names of whom will be found in the *Students' Handbook*, or from the office of the General Secretary of the S.C.M. in Hart House. Students at Ajax are invited to make the acquaintance of the resident chaplain, the Rev. L. Carl Swan, in Hart House Ajax and to participate in the life and work of the university community church which is under his direction.

VARSITY CHRISTIAN FELLOWSHIP

The Engineering Branch of the Varsity Christian Fellowship is affiliated with the campus-wide Varsity Christian Fellowship which in turn is a part of the world-wide Inter-Varsity Christian Fellowship.

The Fellowship is founded on the historic fact that God has revealed Himself in the life, death, and resurrection of His Son, Jesus Christ; that personal faith in Him results in the forgiveness of sin, victory over sin, and a new joyful life purpose. The Fellowship is seeking to bear witness to the vitality of this faith and to the power of the Saviour in every relationship of life.

Through the activities, which are open to all undergraduates, it seeks to show the applicability of these principles to an individual in business or professional life.

These activities embrace (*a*) daily prayer meetings at 8.15 a.m. in Hart House Chapel, (*b*) weekly noon-hour meetings on Tuesdays and (*c*) special events such as dinners, firesides, and sing songs. The officers are listed in the *Students' Handbook* and announcements are made in the ***Varsity***.

UNIVERSITY OF TORONTO

UNIVERSITY NAVAL TRAINING DIVISION

The University Naval Training Division (U.N.T.D.) was formed in the Spring of 1943 by Naval Service Headquarters, the primary purpose being to prepare students for eventual active service with the Royal Canadian Naval Volunteer Reserve during hostilities. The peacetime purpose of the U.N.T.D. is to keep the students interested in the Canadian Navy and to qualify them, as potential officer material, for commissions in the Naval Reserve.

Unlike men of the Royal Canadian Navy who are enrolled for five years' service, students in the U.N.T.D. are attested on Divisional Strength in the R.C.N.V.R.,—that is, as part of the Naval Reserve.

Students of the U.N.T.D., University of Toronto, are part of the complement of H.M.C.S. York, and their administration, training, and discipline are under the jurisdiction of the Commanding Officer, H.M.C.S. York.

While enrolled in the U.N.T.D. students wear uniforms similar to those of corresponding rate in the R.C.N. Students may wear uniforms only on parade days.

All students, including Dental and Medical, are enrolled as Ordinary Seamen. Transfers to the rating of Stoker are limited to Mechanical Engineering students who have reached that actual field of study or who have taken the Stokers' training during a summer earlier in their University career. Other ratings who are pursuing university courses which would fit them for consideration as Technical Officers are so designated but remain in the seaman branch.

U.N.T.D. ratings are given a minimum of 60 hours' training during the academic year and a minimum of two weeks' training with active service pay at the Coast during the summer months. The syllabus of training is progressive from year to year, and covers the basic training given to active service ratings in Divisional establishments, including Seamanship, Rifle Drill, Visual Signalling, and lectures on Naval Regulations.

The Ship's Office of the U.N.T.D. is located at 119 St. George Street, Telephone MIdway 1958, with the following in charge:

Area Commanding Officer....Commander G. F. McCrimmon, R.C.N.V.R.

Commanding Officer.........Lieut.-Cmdr. (SB) D. A. F. Robinson, R.C.N.V.R.

Divisional Officer............Lieutenant G. D. Hay, R.C.N.V.R.

UNIVERSITY OF TORONTO CONTINGENT CANADIAN OFFICERS TRAINING CORPS

The Contingent has reverted to its normal peace-time function of training university students to qualify as officers in the Canadian Army. The Unit had been used during the war to provide the compulsory military training required under the N.R.M. Act for male students liable for military service as well as the selection of suitable candidates for officer instruction.

The Director of Military Training at National Defence Headquarters has stated that the C.O.T.C. is now looked upon as the chief source of officers for the Canadian Army. This is in view of the record of the officers who received their training in this Corps before and during the war.

While training is now voluntary, it offers a valuable opportunity for students to prepare themselves, while pursuing their studies, to become leaders in the responsible direction of the defence forces of Canada.

At the present time training is carried out along the following lines:

(*a*) Students without former military experience are provided with basic (soldier) training during the first year or two, depending on their own progress, before proceeding to officer training.

(*a*) Returned soldiers and members of the Corps who have completed basic training may exchange training toward officer qualification.

The Contingent is also offering a course leading to qualification as Cadet Instructor to students preparing for the teaching profession.

Contingent Headquarters are situated at 119 St. George Street. Accommodation includes drill hall, arms room, Q.M. Stores, and lecture rooms. The Contingent staff for the session 1945-1946 was:

Honorary Colonel	Colonel H. J. Cody, C.M.G., E.D.
Commanding Officer	Lieut.-Col. W. S. Wilson, E.D.
Second-in-Command	Major M. B. Watson, E.D.
Adjutant	Major H. C. H. Miller
Training Officers	Major G. R. Lane Capt. E. L. Gibson
Quartermaster	Capt. C. A. Johnston
Chaplain	Hon. Capt. W. C. Lockhart, C.C.S.
Medical Officers	Capt. H. A. Burnett, R.C.A.M.C. Capt. D. L. Selby, R.C.A.M.C.

UNIVERSITY ADVISORY BUREAU FOR EX-SERVICE STUDENTS

Under authority of the Board of Governors of the University, an Advisory Bureau for ex-service students has been formed at the University. It is located on the Queen's Park Campus at 67 St. George Street, telephone—MI 3791. At Ajax the Bureau is located in Hart House, Ajax. Students may visit the Bureau at any time in connection with any matter financial, educational, personal, and the problem will be dealt with promptly. The Bureau performs certain services but there is no overlapping or duplication of services already provided. Where possible the veteran is referred to existing services or agencies. Direct appointments will be made for the ex-service man, thus saving waste of time.

The personnel counsellors associated with the Bureau, are qualified faculty members, who have seen service in the late war, and have for the most part been associated with the Personnel or Rehabilitation Directorates of the Navy, Army and Air Force.

Over-all policy relating to the operation of the Bureau isn cotrolled by the President's Advisory Committee for ex-service students representing all Colleges and faculties and other agencies on the campus under the chairmanship of Professor W. Line of the Department of Psychology.

The actual operation of the Bureau is in the hands of a working committee of faculty members under the chairmanship of Dr. J. R. McIntosh. The office of the Bureau at Queen's Park is staffed by a full-time executive secretary, Mrs. Margery King. At Ajax, the office of the Bureau is directed by Miss Martin.

SECTION XVII. LODGING AND BOARD

GENERAL

For students who are not accommodated in the University and College residences, the Students' Administrative Council prepares annually a list of inspected and approved rooming houses. This list may be consulted at the office in Hart House two weeks prior to the opening of the Michaelmas term and throughout the session.

RESIDENCE FOR MEN

Through the generosity of the late E. C. Whitney, Esq., Mrs. Whitney, and friends, the University offers to approximately one hundred and fifty men the advantages of residential life within its own grounds. The Residence consists of three Houses: South, East and North.

The regular rates are $4.00 a week for a single room or half of a suite (two bedrooms and common study). Occupants are required to pay their residence dues in two instalments, the first instalment, for the Michaelmas term, on entrance and the second instalment, for the Easter term, in January.

Except under very special circumstances, occupants will be required to remain in the Residence for the full academic session. Occupants who obtain permission to withdraw will be required to give two weeks' notice and to forfeit their deposits.

Applications for rooms must be submitted to the Secretary of the Residence Committee, Registrar's Office, Simcoe Hall. Forms for this purpose will be supplied on request. Each application must be accompanied by a deposit of $5.00. This deposit will be returned if the applicant is not admitted, but will be forfeited if written notice of non-acceptance of a room assigned is not received by the Secretary before September 15th. If such notification is not received until after the opening of the session, the applicant will forfeit his deposit and will be required to pay a penalty of two weeks' room rent. On request the deposit will be refunded in full at the end of the college year if the room key is returned and the room and furniture left in a satisfactory condition.

The University lays down three general rules designed to prevent hazing, gambling, and the use of intoxicants.

A circular giving further information may be obtained from the Secretary of the Residence Committee.

AJAX DIVISION RESIDENCES

The residences at Ajax accommodate 50 or 80 students each, depending on the type of building. All residences are equipped with study rooms, kitchenette, common room, telephone and other facilities. Students are accommodated two to a room.

Meals are served in the central cafeteria. The charge for residence

dues including room and board for the session will be approximately $270.00. It should be noted that:

(*a*) Meals included in the above rate are from Monday to Saturday noon, inclusive.

(*b*) Saturday evening and Sunday meals will be on a cash basis.

(*c*) Meals during vacation periods are not included in the above rate. Such meals will be on a cash basis.

Residence Dues are payable at the Bursar's Office, Ajax Division, York Hall, Ajax, Ontario.

A student is required to remain in residence for the entire session. Permission to withdraw may be given by the Residence Committee only in exceptional circumstances.

Students in residence are required to abide by the residence regulations (Ajax) laid down by the Residence Committee, and the three general University rules designed to prevent hazing, gambling or the use of intoxicants on University property.

Application forms for residence may be obtained from the Registrar's Office, Simcoe Hall, Toronto, or the Supervisor of Residences, Ajax Division, Ajax, Ontario. The completed application must be accompanied by a deposit of $5.00 which will be returned if the applicant is not admitted. If the student, after making application, will not require his room, notification should be sent at the earliest possible moment before the opening of the session.

The deposit will be refunded at the end of the session, if the room key is returned and the room furniture left in a satisfactory condition.

As the residence accommodation for the session 1946-47 is limited, students are advised to send their completed applications together with the $5.00 deposit to the Bursar's Office, Ajax Division, University of Toronto, Ajax, Ontario, as early as possible.

Enquiries concerning residences should be addressed to the Supervisor of Residences, Ajax Division.

SUMMARY OF STUDENTS IN ATTENDANCE

Session 1945-46

	Course												
Year	1	2	3	4	5	6	7	8	8a	9	10	11	Total
I.....	52	21	67	26	28	63	117	9	2	11	25	..	421
I Ajax.	196	68	284	100	100	212	305	34	13	36	62	..	1,410
II.....	93	12	121	28	55	95	109	15	7	5	34	40	614
III.....	41	9	66	10	26	68	50	12	4	6	19	..	311
IV.....	52	3	72	11	21	57	49	17	5	2	11	..	300
V.....	..	..	..	10	..	..	..	..	..	..	..	..	10
	434	113	610	185	230	495	630	87	31	60	151	40	3,066
							Colonial Surveyors						5
													3,071

For graduate students, see p. 217

SECTION XVIII. THE ENGINEERING ALUMNI ASSOCIATION

This calendar presents in outline the courses offered in the Faculty of Applied Science and Engineering, as well as an indication of opportunities which are open to undergraduates for a broadening of their interests by participation in the extra-curricular activities of the Faculty and University.

After spending a few years under the stimulating and maturing influence of college life it is natural that students should, after graduation, feel a desire to preserve the friendships formed in undergraduate days, and should seek to extend the opportunity for further interest and service on behalf of Faculty and Alma Mater.

Many Engineering graduates, who recall their college days with pleasure and a sense of indebtedness, have felt this desire which has found expression in the formation of the Engineering Alumni Association. With succeeding years of mellowing traditions and fresh infusions of new members annually, it has grown in enthusiasm as well as in size. Each graduating class appoints its own permanent executive, thus retaining its identity and through the inspiration and leadership of the Engineering Alumni Association all find a common bond of loyalty to "School" and its traditions, and a friendly contact with their fellows.

Every three years a reunion of "School" graduates is held to bring them together for a renewal of old associations with classmates and with staff. Between times the Association carries on its work through its Council. The extent of these activities is well exemplified by naming such council committees as Membership, Scholarship, Class Organizations, Undergraduate Relations, Engineering Education, Reunions, Publicity, and Federation Affairs. Certain members of the Council are constituted as a Junior Panel and maintain close relations with the more recent graduates, while the inclusion of the President of the Engineering Society on the Council ensures liaison with the undergraduate body.

The Engineering Alumni Association serves in the wider sphere of University graduate activities through its membership in the Alumni Federation of the University of Toronto, which was formed from seventeen associations representing various Colleges, Faculties, and Departments in the University. The Federation co-ordinates the activity of all the Associations and edits and publishes the *University of Toronto Monthly*, which contains news items and articles of interest to all graduates. Through Class, Association and Federation the bond is complete and "School" men take pride in the extent to which they have contributed of their counsel and support on such matters as the University and the Faculty may wish to consult the graduate body.

All "School" graduates, and students who have had at least one year in the Faculty of Applied Science and Engineering, are members of the

Engineering Alumni Association and the Alumni Federation; but only those paying the prescribed annual fee of three dollars are entitled to vote, hold office, or exercise the rights and privileges of membership and to receive the *University of Toronto Monthly.* This fee is distributed—one dollar to the Engineering Alumni Association for the maintenance of its activities, and two dollars to the Alumni Federation towards a share of its administrative expenses and for clerical work on behalf of the Association, and to cover the members' subscription to the *University of Toronto Monthly.*

APPENDIX I. GRADUATE STUDIES

Graduates interested in pursuing courses for post-graduate degrees should send inquiries to the Secretary of the School of Graduate Studies.

The University is prepared to offer graduate courses in all of the Departments of the Faculty of Applied Science and Engineering. The degrees offered are M.A.Sc., M.Arch., and Ph.D. These courses are open to graduates of this University or of another University of comparable standing. Candidates must have a sufficiently good undergraduate record in a course closely related to the one they propose to follow.

Various Fellowships, Bursaries, and Scholarships are available to graduate students as shown in the table on page 000. In time of peace many part-time demonstratorships are open which permit graduate work towards a degree. In normal times, also, research assistants are appointed annually on salary in the School of Engineering Research, and this work may be counted as a partial fulfilment of the requirements for a graduate degree.

One full academic year of study is required for the degree of M.A.Sc. and M.Arch. and a minimum of three years for the degree of Ph.D. Part-time work must total to these full-time requirements. To be eligible to receive the degree of Ph.D. the candidate must make an original contribution to knowledge.

REGULATIONS FOR DEGREES

MASTER OF APPLIED SCIENCE, MASTER OF ARCHITECTURE

The regulations governing the Degrees of Master of Applied Science (M.A.Sc.) and Master of Architecture (M.Arch.) shall be determined as follows:

1*a*. A candidate for the degree of Master of Applied Science shall hold the degree of Bachelor of Applied Science of this University or a degree from some other university recognized as equivalent by the Council of the School of Graduate Studies.

1*b*. A candidate for the degree of Master of Architecture shall hold the degree of Bachelor of Architecture or the degree of Bachelor of Applied Science in Architecture of this University or a degree from some other university recognized as equivalent by the Council of the School of Graduate Studies.

2. A candidate wishing to proceed to a graduate degree shall (*a*) register with the Secretary of the School of Graduate Studies at the beginning of the academic year, (*b*) enrol in one of the courses mentioned in Clause 4. As a condition of registration as a candidate proceeding to a degree, he must submit evidence that the department concerned is willing to enrol him.

3. Not later than November 1, 1946, he shall submit to the Secretary

for acceptance by the Council of the School of Graduate Studies the title of his proposed thesis as approved by the department concerned.

4. Not later than May 15, 1947, he shall present evidence to the Council of the School of Graduate Studies that he has spent not less than one academic year in the course concerned as a student enrolled in one of the following courses on a course of study approved by the department: Civil Engineering, Mining Engineering, Mechanical Engineering, Architecture, Engineering Physics, Chemical Engineering, Electrical Engineering, Metallurgical Engineering, Mining Geology, Aeronautical Engineering.

5. Not later than May 15, 1947, evidence that the candidate has satisfactorily met all the requirements of the department with regard to thesis and to such examinations as the department shall require, shall be forwarded to the Council of the School of Graduate Studies through the sub-committee administering the regulations governing the degrees of Master of Applied Science and Master of Architecture.

DOCTOR OF PHILOSOPHY

Graduates of the Faculty of Applied Science and Engineering may proceed to the degree of Doctor of Philosophy. Information as to the conditions to be met by candidates for this degree is to be found in the Calendar of the School of Graduate Studies, which may be obtained from the Registrar of the University. The degree is an academic degree, not a professional one, and the research work and courses leading to the degree are primarily concerned with the fundamentals and underlying principles of the sciences. In general, a candidate selects one major and two minor subjects for study, the research being carried out in the major subject. A period of three years is usually required for the fulfilment of the requirements for the degree. However, it should be understood that the degree is not granted for the passing of prescribed courses or for the performance of prescribed laboratory work for a period of three years. The laboratory research work must have led to results of a high order, constituting a real contribution to the science of the major subject, and the candidate must have attained a decided maturity of knowledge and outlook before he may present himself for final examination by the Committee of the School of Graduate Studies. A graduate proposing to proceed to this degree should consult, in the first instance, with the members of the staff in the department in which he proposes to take his major subject.

PROFESSIONAL DEGREES

CIVIL ENGINEER, MINING ENGINEER, MECHANICAL ENGINEER, ELECTRICAL ENGINEER, CHEMICAL ENGINEER, METALLURGICAL ENGINEER

The regulations governing the Professional Degrees of Civil Engineer (C.E.), Mining Engineer (M.E.), Mechanical Engineer (Mech.E.), Elec-

trical Engineer (E.E.), Chemical Engineer (Chem.E.), Metallurgical Engineer (Met.E.), for the session 1946-47 shall be determined as follows:

1. A candidate for one of the said degrees shall hold the diploma of the School of Practical Science or of the Faculty of Applied Science and Engineering or the degree of Bachelor of Applied Science, or shall have spent not less than two years as a member of the teaching staff in this Faculty after having graduated in engineering from another institution of recognized reputation.

2. He shall have spent at least three years after receiving the diploma or the degree in the actual practice of the branch of engineering wherein he is a candidate for a degree.

3. Intervals of non-employment, or of employment in other branches of engineering, shall not be included in the above three years. It shall not be necessary that the several periods requisite to make up the said three years be consecutive.

4. The candidate shall obtain from the Secretary of the School of Graduate Studies the regular application form which, properly filled out, accompanied by the designated evidence of professional experience and by the title and synopsis of the proposed thesis, shall be delivered to the Secretary not later than the first day of November.

The evidence of professional experience shall fully describe the kind and extent of all work undertaken by the candidate since the date of graduation up to the time of application, indicating clearly the degree of responsibility for such work. Certificates from present and past employers shall accompany the application. The names and addresses of not less than five engineers to whom the candidate is personally known and who have knowledge of his professional activities shall be submitted.

5. The application and the subject of the thesis are subject to the approval of the Board of Examiners, who may satisfy themselves by oral or written examinations in regard to the candidate's experience and competence in engineering works.

6. The candidate after notification of the approval of the Board shall prepare an original engineering thesis in the branch in which he has applied for a degree. This thesis shall be on work in which the candidate has had actual experience and shall preferably be in the form of an engineer's report on the design of engineering works, or on processes, and accompanied by all necessary descriptions, details, drawings, bills of materials, specifications and estimates. (Note that a thesis of a solely descriptive type will not be acceptable.)

7. The thesis, with accompanying papers, described in clause 6, shall be sent to the Secretary not later than the first day of March.

8. The candidate may be required to present himself for examination in the months of March or April at such time as may be arranged by the Examiners.

9. The thesis, drawings and other papers submitted under clause 7, shall become the property of the University.

10. Nothing in these regulations shall prevent any candidate from receiving more than one of the said degrees, provided he has the necessary qualifications for each degree. An interval of three years must elapse between the granting of any two degrees under these regulations.

HIGH SCHOOL ASSISTANTS' CERTIFICATES, TYPES A AND B

The Department of Education of Ontario has agreed to accept the degree of Bachelor of Applied Science as fulfilling the academic requirement for admission to the course for a High School Assistants' Certificate in the Ontario College of Education.

HIGH SCHOOL ASSISTANTS' CERTIFICATES, TYPE A

By an agreement between the University of Toronto and the Department of Education of Ontario, persons holding the degree of Bachelor of Applied Science may, by taking certain prescribed courses in the Faculty of Arts, complete the academic requirements for admission to the qualifying examination for courses leading to High School Assistants' Certificates, Type A, in (*a*) Mathematics and Physics and (*b*) Science, at the Ontario College of Education. Information regarding these prescribed courses may be obtained from a pamphlet issued by the Registrar of the University, from whom copies may be had on application. Each person who desires to complete these academic requirements should communicate directly with the Registrar in order that his case may be considered and his particular conditions defined.

The Department of Education has approved of the acceptance of the degree in Applied Science in the Course in Engineering Physics, with standing of at least 60% at the final examination, as covering the academic requirements for admission to the qualifying examination for the course leading to High School Assistants' Certificates, Type A, in Mathematics and Physics at the Ontario College of Education.

ONTARIO LAND SURVEYORS AND DOMINION LAND SURVEYORS

Examinations are held usually in February of each year, for the following:

- Preliminary Dominion Land Surveyors
- Leveller's Examination
- Final Dominion Land Surveyors
- Ontario Land Surveyors

Any student of the Faculty of Applied Science and Engineering is eligible for these examinations, but graduates in Civil and Mining Engineering are allowed a shortened apprenticeship before writing their final examinations. Full information respecting above examinations may be obtained from the staff in Surveying and Geodesy.

GRADUATES ENROLLED IN THE FACULTY OF APPLIED SCIENCE AND ENGINEERING

Civil Engineering	5
Mining Engineering	3
Mechanical Engineering	12
Architecture	1
Engineering Physics	21
Chemical Engineering	11
Electrical Engineering	12
Metallurgical Engineering	7
Mining Geology	5
Aeronautical Engineering	1
Total	78

INDEX

Administrative Officers....... 7
Admission, Qualifications and Procedure for....... 21
Advisory Bureau....... 207
Aerodynamic Laboratory....... 187
Aeronautical Engineering.......28, 72, 78
Ajax Division Libraries....... 175
Alternating Current Machine Laboratory....... 183
Alumni Association....... 211
Annual Examinations....... 153
Applied Mathematics....... 135
Applied Mechanics....... 80
Applied Physics....... 86
Applied Physics Laboratories....... 185
Architecture....... 89
Architecture, School of.......28, 43
Assaying....... 95
Assaying Laboratory....... 177
Astronomy....... 99
Athletic Association.......200, 203
Attendance, Summary of Students in.......210, 217

Bachelor Degrees....... 28
Botany....... 100
Bursaries....... 155
Business Administration....... 109

Calendar....... 5
Canadian Officers' Training Corps....... 205
Cement Laboratory....... 176
Ceramics and Non-*M*etallic *M*inerals....... 138
Ceramic Engineering.......29, 65
Chemical Engineering.......28, 54, 101
Chemical Engineering Laboratories....... 182
Chemistry....... 101
Civil Engineering.......28, 32, 100
Civil Engineering Laboratories....... 176
Commencement....... 6
Communication Laboratory....... 183
Communication.......49, 51
Conduct of Students....... 190
Constitution, Student Societies....... 200
Courses....... 28
Courses, Graduating.......28, 31
Curriculum....... 31

Degrees....... 28
  Bachelor....... 28
  Master.......29, 213
  Professional.......29, 214
  Ph.D.......29, 214
Departmental Libraries....... 175
Department of Health Laboratory....... 187
Deposits....... 25
Descriptive Geometry....... 106
Design of Structures....... 80

Direct Current Machine Laboratory.... 183
Discipline.... 190
Dominion Land Surveyors.... 216
Drawing.... 89, 106
Economics.... 109
Electrical Engineering.... 28, 58
Electrical Engineering Laboratories.... 182
Electrical Measurements Laboratory.... 183
Electricity.... 113
Electricity and Communication.... 49, 51
Electrochemical Laboratories.... 187
Engineering Alumni Association.... 211
Engineering and Business.... 28, 75
Engineering Problems and Drawing.... 106
Engineering Physics.... 28, 47
Engineering Research, School of.... 30
Engineering Society.... 202
English.... 141
Examinations.... 153
Excursions.... 31
Ex-Service Personnel.... 207

Fees.... 25

Geodesy.... 99
Geological Laboratories.... 188
Geology.... 120
Geological Sciences.... 120, 139
Geophysics.... 49, 52
German.... 141
Graduate Studies.... 213
Graduating Courses.... 28, 31

Hart House.... 197
Hart House—Ajax.... 198
Heat Engine Laboratory.... 179
Heat Engines.... 123
High School Assistants' Certificates.... 216
Highway Laboratory.... 176
Historical Sketch.... 20
Holidays.... 5
Hydraulic Laboratory.... 180
Hydraulics.... 126
Hydrostatics.... 126

Illumination and Acoustics.... 49, 53
Inquiries.... 7

Laboratories.... 175
Languages.... 141
Law.... 109
Lecture and Laboratory Subjects.... 78
Libraries.... 175
Loan Funds.... 155
Lodging and Board.... 208

Machinery.......... 129
Masters Degrees.......... 213
Mathematics..........132, 135
Mechanical Engineering..........28, 40
Mechanical Engineering Laboratories.......... 179
Mechanics.......... 80
Mechanics of Materials Laboratory.......... 176
Meetings, Engineering Society.......... 5
Medals.......... 155
Metallurgy.......... 136
Metallurgical Engineering..........29, 62
Metallurgical Engineering Laboratories.......... 184
Metrological Laboratory.......... 186
Mineralogical Laboratories.......... 188
Mineralogy.......... 139
Mining.......... 95
Mining Engineering..........28, 36
Mining Geology..........28, 68
Mining Engineering Laboratories.......... 177
Modern Languages.......... 141
Municipal Engineering.......... 100
Museum, Royal Ontario.......... 189

Naval Training Division, University.......... 204
Non-Metallic Minerals.......... 138

Officers, Administrative.......... 7
Officers' Training Corps, Canadian.......... 205
Ontario Department of Health Laboratory.......... 187
Ontario Land Surveyors.......... 216
Ore Dressing.......... 95
Ore Dressing Laboratory.......... 178

Painting.......... 89
Petrography.......... 139
Ph.D.......... 214
Photographic Laboratory.......... 185
Physical Training..........26, 142, 196
Physics, Applied.......... 86
Physics.......... 142
Practical Experience.......... 146
Professional Degrees.......... 214
Prizes.......... 155

Refrigeration..........50, 53
Registration..........5, 21, 23
Research Assistants.......... 30
Research, School of Engineering.......... 30
Residences.......... 208

Sanitary Engineering Laboratory.......... 187
School of Architecture..........28, 43
School of Engineering Research.......... 30
School of Graduate Studies.......... 213
Scholarships.......... 155
Shop Work..........40, 147

Sickness.......... 153
Soil Mechanics Laboratory.......... 176
Soldiers' Tower.......... 198
Specialists' Certificates.......... 216
Spectroscopy..........49, 51
Staff, Teaching.......... 8
Structures, Design of.......... 80
Student Christian Movement.......... 203
Students' Administrative Council.......... 200
Student Organizations.......... 200
Supplemental Examinations.......... 154
Summary of Students in Attendance..........210, 217
Surveying.......... 148
Survey Camp..........5, 150, 185

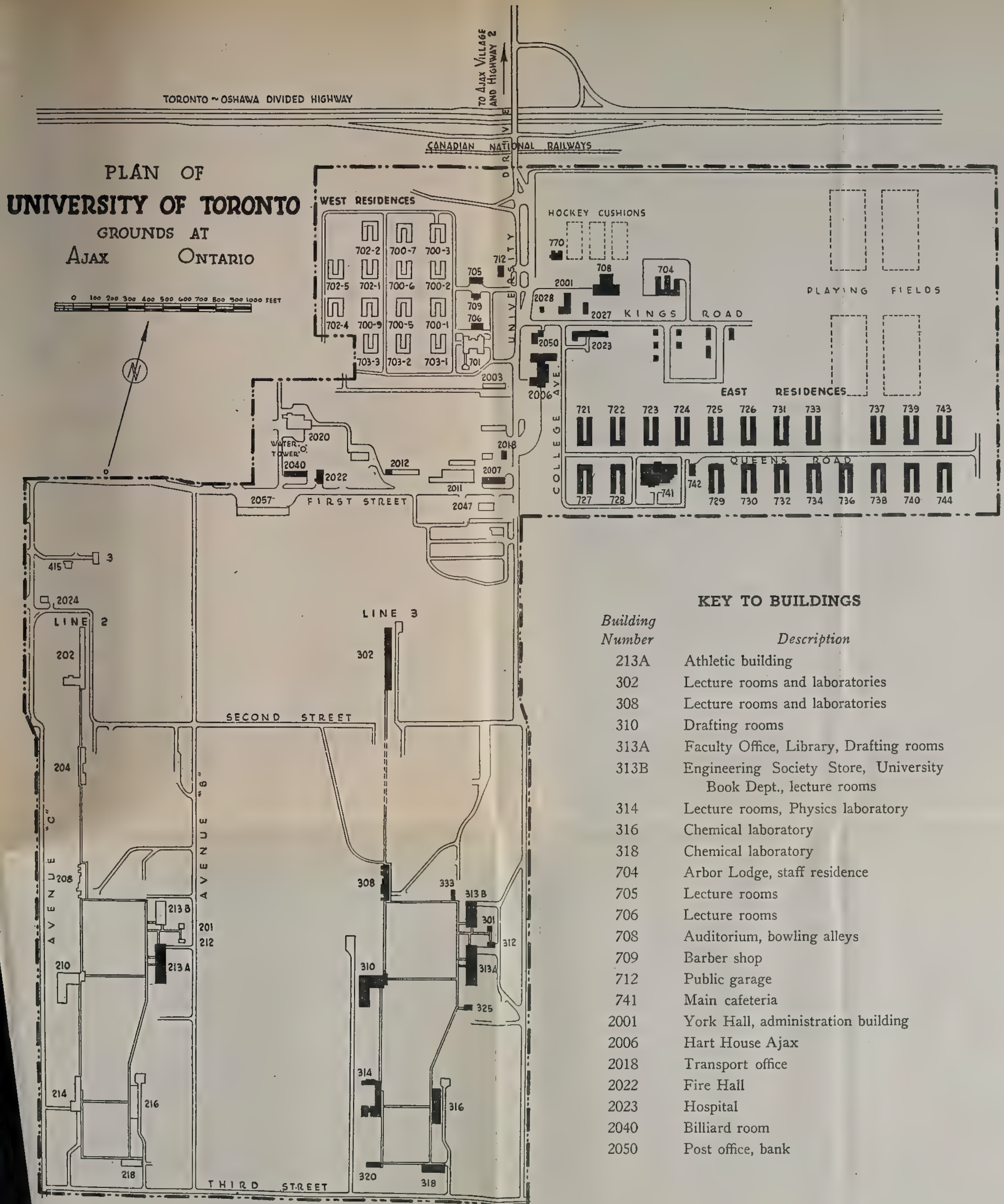
Teachers' Certificates.......... 216
Term Examinations.......... 154
Theatre, Hart House.......... 198
Thesis.......... 150

University Health Service.......... 192
University Naval Training Division.......... 204
University Survey Camp.......... 185

Vaccination.......... 23

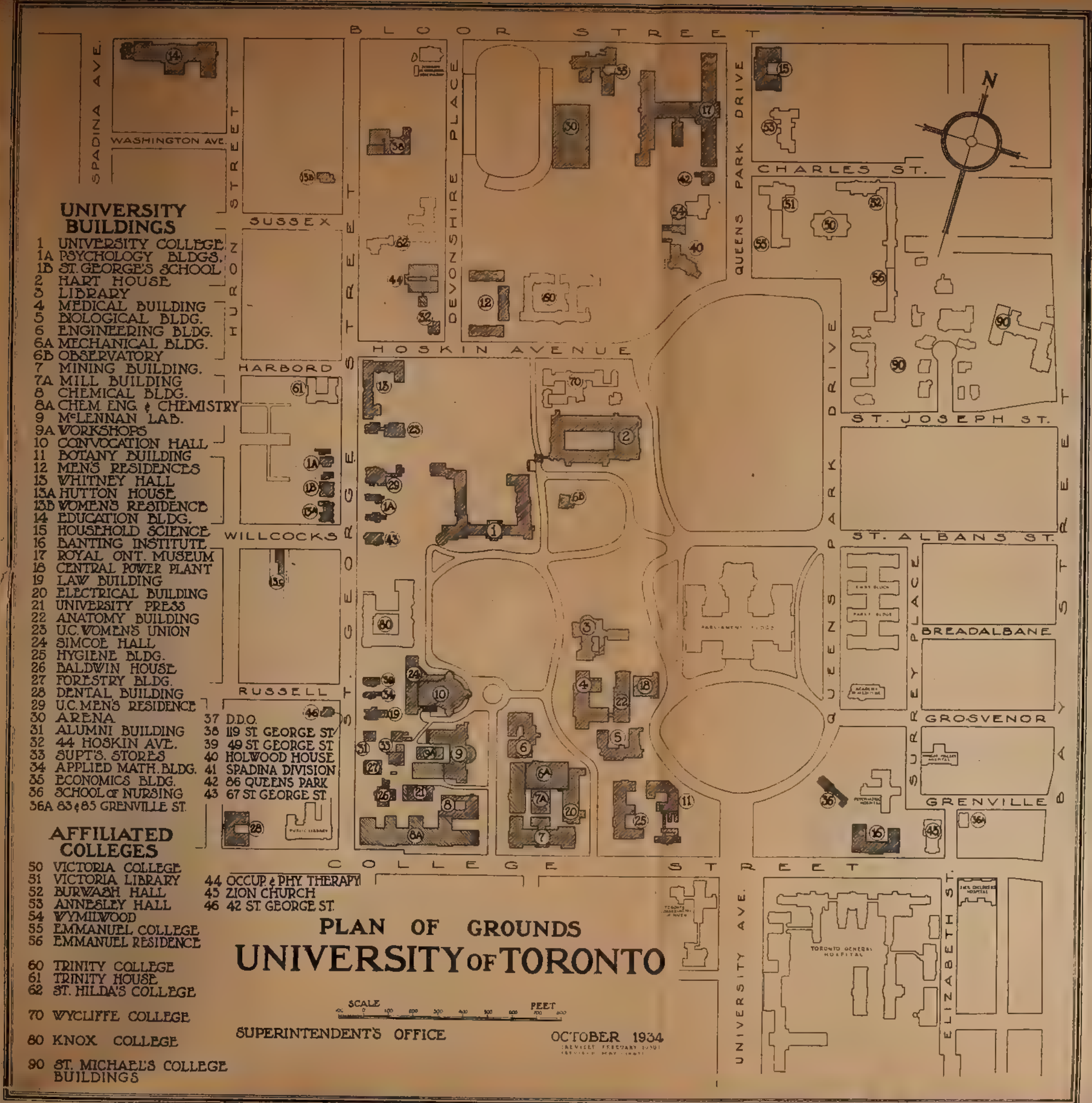
X-Rays and Spectroscopy..........49, 51

Zymology.......... 152



KEY TO BUILDINGS

Building Number	*Description*
213A	Athletic building
302	Lecture rooms and laboratories
308	Lecture rooms and laboratories
310	Drafting rooms
313A	Faculty Office, Library, Drafting rooms
313B	Engineering Society Store, University Book Dept., lecture rooms
314	Lecture rooms, Physics laboratory
316	Chemical laboratory
318	Chemical laboratory
704	Arbor Lodge, staff residence
705	Lecture rooms
706	Lecture rooms
708	Auditorium, bowling alleys
709	Barber shop
712	Public garage
741	Main cafeteria
2001	York Hall, administration building
2006	Hart House Ajax
2018	Transport office
2022	Fire Hall
2023	Hospital
2040	Billiard room
2050	Post office, bank


BLOOR STREET
COLLEGE STREET
SPADINA AVE.
WASHINGTON AVE.
HURON STREET
SUSSEX
HARBORD
WILLCOCKS
RUSSELL
ST. GEORGE STREET
DEVONSHIRE PLACE
HOSKIN AVENUE
QUEENS PARK DRIVE
QUEENS PARK
CHARLES ST.
ST. JOSEPH ST.
ST. ALBANS ST.
BREADALBANE
GROSVENOR
GRENVILLE
SURREY PLACE
BAY STREET
UNIVERSITY AVE.
ELIZABETH ST.
N
UNIVERSITY BUILDINGS
1 UNIVERSITY COLLEGE
1A PSYCHOLOGY BLDGS.
1B ST. GEORGE'S SCHOOL
2 HART HOUSE
3 LIBRARY
4 MEDICAL BUILDING
5 BIOLOGICAL BLDG.
6 ENGINEERING BLDG.
6A MECHANICAL BLDG.
6B OBSERVATORY
7 MINING BUILDING.
7A MILL BUILDING
8 CHEMICAL BLDG.
8A CHEM. ENG. & CHEMISTRY
9 McLENNAN LAB.
9A WORKSHOPS
10 CONVOCATION HALL
11 BOTANY BUILDING
12 MEN'S RESIDENCES
13 WHITNEY HALL
13A HUTTON HOUSE
13B WOMEN'S RESIDENCE
14 EDUCATION BLDG.
15 HOUSEHOLD SCIENCE
16 BANTING INSTITUTE
17 ROYAL ONT. MUSEUM
18 CENTRAL POWER PLANT
19 LAW BUILDING
20 ELECTRICAL BUILDING
21 UNIVERSITY PRESS
22 ANATOMY BUILDING
23 U.C. WOMEN'S UNION
24 SIMCOE HALL
25 HYGIENE BLDG.
26 BALDWIN HOUSE
27 FORESTRY BLDG.
28 DENTAL BUILDING
29 U.C. MEN'S RESIDENCE
30 ARENA
31 ALUMNI BUILDING
32 44 HOSKIN AVE.
33 SUPT'S. STORES
34 APPLIED MATH. BLDG.
35 ECONOMICS BLDG.
36 SCHOOL OF NURSING
36A 83 & 85 GRENVILLE ST.
37 D.D.O.
38 119 ST. GEORGE ST.
39 49 ST. GEORGE ST.
40 HOLWOOD HOUSE
41 SPADINA DIVISION
42 86 QUEENS PARK
43 67 ST. GEORGE ST.
44 OCCUP. & PHY. THERAPY
45 ZION CHURCH
46 42 ST. GEORGE ST.
AFFILIATED COLLEGES
50 VICTORIA COLLEGE
51 VICTORIA LIBRARY
52 BURWASH HALL
53 ANNESLEY HALL
54 WYMILWOOD
55 EMMANUEL COLLEGE
56 EMMANUEL RESIDENCE
60 TRINITY COLLEGE
61 TRINITY HOUSE
62 ST. HILDA'S COLLEGE
70 WYCLIFFE COLLEGE
80 KNOX COLLEGE
90 ST. MICHAEL'S COLLEGE BUILDINGS
PARLIAMENT BLDGS.
EAST BLOCK
WEST BLOCK
TORONTO GENERAL HOSPITAL
PUBLIC LIBRARY
PLAN OF GROUNDS
UNIVERSITY OF TORONTO
SCALE
FEET
SUPERINTENDENT'S OFFICE
OCTOBER 1934

UNIVERSITY OF TORONTO

CALENDAR

Faculty of Applied Science and Engineering

1947-1948

THE UNIVERSITY OF TORONTO PRESS

CONTENTS

		Foreword	3
SECTION	I.	Calendar	5
"	II.	Administrative Officers	7
"	III.	Teaching Staff	8
"	IV.	Historical Sketch	23
"	V.	Admission and Registration	24
"	VI.	Fees, Deposits and Expenses	28
"	VII.	Courses and Degrees	31
"	VIII.	School of Engineering Research	33
"	IX.	Curriculum	34
"	X.	Examinations	156
"	XI.	Scholarships	158
"	XII.	Libraries and Laboratories	183
"	XIII.	Discipline	198
"	XIV.	University Health Service and Physical Training	200
"	XV.	Hart House	204
"	XVI.	Student Organizations	207
"	XVII.	Lodging and Board	215
"	XVIII.	Engineering Alumni Association	218
		Appendix I—Graduate Studies	220
		Index	225

FOREWORD

During the summer of 1945, the University was faced with the difficult problem of providing accommodation for almost double the number of students that had been registered in the previous year. Through the efforts of the Chairman of the Board of Governors, and the President, the University leased from the Crown, part of the huge shell-filling plant at Ajax, twenty-five miles east of Toronto, to relieve the heavy demand for space at Queen's Park. Because it became evident, at an early stage, that a relatively large number of students would register in the Faculty of Applied Science and Engineering, it was decided that the work of the First and Second Years of this Faculty should be given at Ajax.

A special First Year session with approximately 1400 students commenced at Ajax on January 14, 1946. In the regular 1946-47 session both First and Second Year instruction, except Second Year in Architecture, was given at Ajax with 1800 registered in First Year and 1500 in Second Year. For the session 1947-48 First and Second Year instruction, except Second Year Architecture, will be given at Ajax. All other instruction will be given in Toronto.

To provide for this self-contained University community at Ajax, there are 446 acres and 111 buildings. The University operates such services as: central heating, road maintenance, water supply, sewage disposal, fire department, transportation, post office, laundry, private hospital, cafeteria, tuck shop and barber shop. Former production-line buildings were altered to accommodate 37 lecture rooms, 20 draughting rooms and 14 laboratories. In the 1946-47 session, 2300 students were in residence occupying 32 buildings. Student life at Ajax compares favourably with that in Toronto, excellent accommodation being provided for the following: a general circulating library, a technical library, Hart House Ajax, the Athletic Association, the Health Service, Students' Administrative Council, Advisory Bureau for Ex-Service Students, and a small chapel.

1947 CALENDAR 1947

JANUARY		FEBRUARY		MARCH		APRIL	
Sun.	.. 5 12 19 26	Sun.	.. 2 9 16 23	Sun.	2 9 16 23 30	Sun.	.. 6 13 20 27
Mon.	.. 6 13 20 27	Mon.	.. 3 10 17 24	Mon.	3 10 17 24 31	Mon.	.. 7 14 21 28
Tues.	.. 7 14 21 28	Tues.	.. 4 11 18 25	Tues.	4 11 18 25	Tues.	1 8 15 22 29
Wed.	1 8 15 22 29	Wed.	.. 5 12 19 26	Wed.	5 12 19 26	Wed.	2 9 16 23 30
Thur.	2 9 16 23 30	Thur.	.. 6 13 20 27	Thur.	6 13 20 27	Thur.	3 10 17 24 ....
Fri.	3 10 17 24 31	Fri.	.. 7 14 21 28	Fri.	7 14 21 28	Fri.	4 11 18 25 ....
Sat.	4 11 18 25	Sat.	1 8 15 22	Sat.	1 8 15 22 29	Sat.	5 12 19 26 ....

MAY		JUNE		JULY		AUGUST	
Sun.	.. 4 11 18 25	Sun.	1 8 15 22 29	Sun.	.. 6 13 20 27	Sun.	3 10 17 24 31
Mon.	.. 5 12 19 26	Mon.	2 9 16 23 30	Mon.	.. 7 14 21 28	Mon.	4 11 18 25 ....
Tues.	.. 6 13 20 27	Tues.	3 10 17 24	Tues.	1 8 15 22 29	Tues.	5 12 19 26 ....
Wed.	.. 7 14 21 28	Wed.	4 11 18 25	Wed.	2 9 16 23 30	Wed.	6 13 20 27 ....
Thur.	1 8 15 22 29	Thur.	5 12 19 26	Thur.	3 10 17 24 31	Thur.	7 14 21 28 ....
Fri.	2 9 16 23 30	Fri.	6 13 20 27	Fri.	4 11 18 25	Fri.	1 8 15 22 29 ....
Sat.	3 10 17 24 31	Sat.	7 14 21 28	Sat.	5 12 19 26	Sat.	2 9 16 23 30 ....

SEPTEMBER		OCTOBER		NOVEMBER		DECEMBER	
Sun.	.. 7 14 21 28	Sun.	.. 5 12 19 26	Sun.	2 9 16 23 30	Sun.	.. 7 14 21 28
Mon.	1 8 15 22 29	Mon.	.. 6 13 20 27	Mon.	3 10 17 24	Mon.	1 8 15 22 29
Tues.	2 9 16 23 30	Tues.	.. 7 14 21 28	Tues.	4 11 18 25	Tues.	2 9 16 23 30
Wed.	3 10 17 24	Wed.	1 8 15 22 29	Wed.	5 12 19 26	Wed.	3 10 17 24 31
Thur.	4 11 18 25	Thur.	2 9 16 23 30	Thur.	6 13 20 27	Thur.	4 11 18 25 ....
Fri.	5 12 19 26	Fri.	3 10 17 24 31	Fri.	7 14 21 28	Fri.	5 12 19 26 ....
Sat.	6 13 20 27	Sat.	4 11 18 25	Sat.	1 8 15 22 29	Sat.	6 13 20 27 ....

1948 CALENDAR 1948

JANUARY		FEBRUARY		MARCH		APRIL	
Sun.	.. 4 11 18 25	Sun.	1 8 15 22 29	Sun.	.. 7 14 21 28	Sun.	.. 4 11 18 25
Mon.	.. 5 12 19 26	Mon.	2 9 16 23	Mon.	1 8 15 22 29	Mon.	.. 5 12 19 26
Tues.	.. 6 13 20 27	Tues.	3 10 17 24	Tues.	2 9 16 23 30	Tues.	.. 6 13 20 27
Wed.	.. 7 14 21 28	Wed.	4 11 18 25	Wed.	3 10 17 24 31	Wed.	.. 7 14 21 28
Thur.	1 8 15 22 29	Thur.	5 12 19 26	Thur.	4 11 18 25	Thur.	1 8 15 22 29
Fri.	2 9 16 23 30	Fri.	6 13 20 27	Fri.	5 12 19 26	Fri.	2 9 16 23 30
Sat.	3 10 17 24 31	Sat.	7 14 21 28	Sat.	6 13 20 27	Sat.	3 10 17 24 ....

MAY		JUNE		JULY		AUGUST	
Sun.	2 9 16 23 30	Sun.	.. 6 13 20 27	Sun.	.. 4 11 18 25	Sun.	1 8 15 22 29
Mon.	3 10 17 24 31	Mon.	.. 7 14 21 28	Mon.	.. 5 12 19 26	Mon.	2 9 16 23 30
Tues.	4 11 18 25	Tues.	1 8 15 22 29	Tues.	.. 6 13 20 27	Tues.	3 10 17 24 31
Wed.	5 12 19 26	Wed.	2 9 16 23 30	Wed.	.. 7 14 21 28	Wed.	4 11 18 25 ....
Thur.	6 13 20 27	Thur.	3 10 17 24	Thur.	1 8 15 22 29	Thur.	5 12 19 26 ....
Fri.	7 14 21 28	Fri.	4 11 18 25	Fri.	2 9 16 23 30	Fri.	6 13 20 27 ....
Sat.	1 8 15 22 29	Sat.	5 12 19 26	Sat.	3 10 17 24 31	Sat.	7 14 21 28 ....

SEPTEMBER		OCTOBER		NOVEMBER		DECEMBER	
Sun.	.. 5 12 19 26	Sun.	3 10 17 24 31	Sun.	.. 7 14 21 28	Sun.	.. 5 12 19 26
Mon.	.. 6 13 20 27	Mon.	4 11 18 25	Mon.	1 8 15 22 29	Mon.	.. 6 13 20 27
Tues.	.. 7 14 21 28	Tues.	5 12 19 26	Tues.	2 9 16 23 30	Tues.	.. 7 14 21 28
Wed.	1 8 15 22 29	Wed.	6 13 20 27	Wed.	3 10 17 24	Wed.	1 8 15 22 29
Thur.	2 9 16 23 30	Thur.	7 14 21 28	Thur.	4 11 18 25	Thur.	2 9 16 23 30
Fri.	3 10 17 24	Fri.	1 8 15 22 29	Fri.	5 12 19 26	Fri.	3 10 17 24 31
Sat.	4 11 18 25	Sat.	2 9 16 23 30	Sat.	6 13 20 27	Sat.	4 11 18 25 ....

SECTION I. CALENDAR 1947-1948

FALL TERM 1947

May 3 Sat.......	Students of the III Year, Courses 1, 2, and 9, report at Survey Camp (Course 1 at Ajax, Courses 2 and 9 at Gull Lake).
July 15 Tues.....	Last day for receiving applications for Supplemental Examinations.
Aug. 23 Sat.......	Students of the III Year, Courses 1, 2, and 9, report at Survey Camp. (Course 1 at Dorset, Courses 2 and 9 at Gull Lake).
Sept. 1 Mon.....	Labour Day. Buildings closed.
Sept. 2 Tues.....	Last day for receiving applications for admission to the I Year.
	Students of the II Year, Course 6, report at Ajax for Chemical Laboratory.
Sept. 8 Mon.....	Supplemental Examinations commence. All written Supplementals will be held in Toronto.
Sept. 15-20 Mon.-Sat....	Registration in person of the I Year from 9.30 a.m. to 12 noon and from 2.00 p.m. to 4.30 p.m., (Saturday 9.30 a.m. to 12.00 noon) at Ajax and Toronto.
Sept. 18 Thurs....	Special meeting of Faculty Council.
Sept. 22 Mon.....	Students in Architecture of the III, and IV Years report at the Sketching Camp at Dorset.
Sept. 22-23 Mon.-Tues..	Registration in person of the II Year (except Architecture) from 9.30 a.m. to 12.00 noon and 2.00 p.m. to 4.30 p.m., at Ajax.
	Registration in person of the III Year (except Architecture) from 9.30 a.m. to 12.00 noon, and 2.00 p.m. to 4.30 p.m. at the Mining Building, Toronto.
Sept. 23 Tues.....	Registration in person of the III and IV Years (except Architecture) and II and V Years Architecture from 9.30 a.m. to 12.00 noon, and 2.00 p.m. to 4.30 p.m., at the Mining Building, Toronto.
	Dean's address to the I Year at Ajax.
	Preliminary instruction to the I Year at Ajax.
	Meeting of Faculty Council.
Sept. 24 Wed......	Lectures and laboratory work commence at 9.00 a.m.
	The opening address by the President to the Toronto students of all Faculties at 3.45 p.m. in Convocation Hall.
Oct. 1 Wed.....	Registration in person, at the Faculty Office, of III, and IV Years in Architecture, from 9.30 a.m., to 12 noon.

Oct. 2 Thurs....The opening address by the President to the Ajax students at 3.45 p.m. in the Recreation Hall, Ajax,
Oct. 3 Fri.......Meeting of Faculty Council.
Oct. 10 Fri.......Meeting of Senate.
Oct. 11 Sat......Meeting of Caput.
Oct. 13 Mon.....Meeting of Engineering Society.
Nov. 3 Mon.....Meeting of Faculty Council.
Nov. 11 Tues.....Remembrance Day Service at the Soldiers' Tower, Toronto, and at the Recreation Hall, Ajax, at 10.45 a.m. Neither lectures nor laboratory classes given from 10.00 a.m. to 11.15 a.m.
Meeting of Engineering Society.
Nov. 14 Fri.......Fall Convocation and meeting of the Senate.
Dec. 3 Wed.....Meeting of Faculty Council.
Dec. 10 Wed.....Meeting of Engineering Society.
Dec. 12 Fri.......Meeting of Senate.
Dec. 15 Mon.....I Year Term Examinations commence.
Dec. 19 Fri.......Term ends at 5.00 p.m.

SPRING TERM 1948

Jan. 1 Thurs....Buildings closed.
Jan. 5 Mon.....Spring Term begins.
Mid-session Examinations commence.
Jan. 9 Fri.......Meeting of Senate.
Jan. 12 Mon.....Meeting of Faculty Council.
Jan. 15 Thurs....Last day for receiving the second term instalment of fees.
Jan. 20 Tues.....Meeting of Engineering Society.
Feb. 3 Tues.....Meeting of Faculty Council.
Feb. 12 Thurs....Meeting of Engineering Society.
Feb. 13 Fri.......Meeting of Senate.
Feb. 25 Wed.....Meeting of Engineering Society (nominations).
Feb. 27 Fri.......Engineering Society Annual Elections.
Mar. 1 Mon.....Engineering Society Annual General Meeting.
Mar. 3 Wed.....Meeting of Faculty Council.
Mar. 12 Fri.......Meeting of Senate.
Mar. 26 Fri.......Good Friday.
Apr. 1 Thurs....Meeting of Faculty Council.
Apr. 3 Sat.......Term ends at 12.00 noon.
Apr. 8 Thurs....Annual Examinations commence.
Apr. 9 Fri.......Meeting of Senate.
May 3 Mon.....Meeting of Faculty Council.
May 14 Fri.......Meeting of Senate.
May 31 Mon.....Meeting of Senate.
June 3-4 Thurs.-
Fri....University Commencement.

SECTION II. ADMINISTRATIVE OFFICERS

THE UNIVERSITY

President . . . . . Sidney Smith, K.C., M.A., LL.B., LL.D., D.C.L.

Registrar . . . . A. B. Fennell, M.C., M.A.
Librarian . . . . W. S. Wallace, M.A., F.R.S.C.
Warden of Hart House . . . . N. Ignatieff, M.B.E., B.SC.
Director of University Extension W. J. Dunlop, B.A., B. PAED., LL.D.

Comptroller . . . . Arnold Gaine, M.B.E.
Bursar and Secretary to the Board of Governors . C. E. Higginbottom
Superintendent of Buildings and Grounds . . A. D. LePan, B.A.SC.
Chief Accountant . . . . R. E. Spence, B.A., A.C.A.
Director of University Health Service . . C. D. Gossage, O.B.E., M.D., F.R.C.S.
Assistant Director of University Health Service in Charge of Women
Miss F. H. Stewart, B.A., M.D.
General Manager of the University of Toronto Press . A. G. Burns, B.A.

THE FACULTY OF APPLIED SCIENCE AND ENGINEERING

Dean . . C. R. Young, B.A.SC., C.E., D.ENG., D. ÈS SC. A., M.E.I.C., M.AM. SOC. C.E.
Assistant Dean and Secretary . . W. S. Wilson, E.D., B.A.SC., M.E.I.C.
Assistant Secretary . . . . Miss E. Birkett
Director of Studies, Ajax. W. J. T. Wright, M.B.E., B.A., B.A.SC., M.E.I.C.
Assistant to Director of Studies, Ajax
H. L. Shepherd, B.A.SC., M.E.I.C.

THE AJAX DIVISION

Director . . . . J. R. Gilley, B.A.SC.
Deputy Bursar . . . . G. L. Court, D.F.C., B.COM.
Deputy Superintendent . . . . J. Shortreed, B.A.SC.
University Health Service Staff Physician . W. F. McKenzie, M.C., M.D.
Junior Staff Physician . . . . R. M. Rogers, M.D.
Supervisor, Hart House, Ajax . . . . . . D. L. Emond, B.A.

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1946-47

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G. R. Anderson, M.A., A.M. (Harv.) 5 duMaurier Blvd.
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J. W. Bain, B.A.Sc., F.R.S.C. .... 393 Brunswick Ave.
Professor Emeritus of Chemical Engineering.

G. A. Guess, M.A. (Qu.) Oakville
Professor Emeritus of Metallurgical Engineering

H. E. T. Haultain, C.E. National Club
Professor Emeritus of Mining Engineering

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Professor Emeritus of Electrical Engineering.

DEPARTMENT OF AERONAUTICAL ENGINEERING

T. R. Loudon, V.D., B.A.Sc., M.E.I.C., M.I.Ae.Sc. 189 Sheldrake Blvd.
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Assistant Professor of Architecture.
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A. P. C. ADAMSON, B.A. (Camb.), M.R.A.I.C. — Port Credit
Lecturer in Town Planning and History of Architecture.
S. R. KENT, B.ARCH., M.R.A.I.C. — Ajax
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Assistant Professor of Palaeontology. Islington

J. SATTERLY, M.A. (Camb.), D.Sc. (London), F.R.S.C. 95 Bernard Ave.
Professor of Physics.

F. G. SMITH, M.Sc. (Man.), PH.D. 57 Prince Arthur Ave.
Assistant Professor of Geology.

A. F. C. STEVENSON, M.A., PH.D. (Camb.), F.R.S.C. 28 Summerhill Gdns.
Associate Professor of Applied Mathematics.

W. J. WEBBER, B.A. (Camb.) 18 Kappele Ave.
Associate Professor of Mathematics.

A. WEINSTEIN, PH.D. (Zurich), D.ÈS.SC. (Paris) 469 Spadina Rd.
Associate Professor of Applied Mathematics.

F. E. W. WETMORE, B.Sc. (N.B.), M.A., PH.D. 53 Bayview Ave.
Assistant Professor of Chemistry.

J. T. WILSON, O.B.E., B.A., M.A. (Camb.), PH.D. (Princ.)
Professor of Physics 29 Roxborough St. E.

SECTION IV. HISTORICAL SKETCH

The Legislative Assembly of the Province of Ontario during the Session of 1877 gave its sanction to the establishment of a School of Practical Science on the basis proposed in the memorandum of the Minister of Education confirmed by the Lieutenant-Governor in Council on the 3rd day of February, 1877.

By the scheme thus approved the Government effected an arrangement with the Council of University College whereby the instruction given by its professors and lecturers in all departments of science embraced in the work of the School was made available to students of the School. This arrangement was brought to an end in 1889 by the transfer of the departments of science, above referred to, from University College to the University of Toronto under the operation of the University Federation Act. In order that the students of the School might continue to enjoy the advantage of the instruction of the above departments, the Senate of the University of Toronto passed a statute in October, 1889, affiliating the School with the University. The statute was confirmed by the Lieutenant-Governor on the 30th day of October, 1889.

By an Order-in-Council, approved by the Lieutenant-Governor on the 6th day of November, 1889, a Principal was appointed, and the management of the School was entrusted to a council composed of the Principal as chairman, and the Professors, Lecturers, and Demonstrators appointed in the Teaching Faculty of the School.

On December 14th, 1900, the Senate, by statute subsequently approved by the Lieutenant-Governor in Council, established a Faculty of Applied Science and Engineering but without assuming any liability for its support or maintenance. Under this statute the teaching staff and examiners of the School of Practical Science became the teaching staff and examiners of the Faculty, although the University retained the right to appoint the examiners for the Bachelor of Applied Science and professional degrees. By the University Act of 1906 the School of Practical Science became the Faculty of Applied Science and Engineering of the University of Toronto.

On April 8th, 1892, the Senate of the University established the Degree of B.A.Sc., which was open to those who held the Diploma of the School and were prepared to devote a fourth year to advanced work. In the Session of 1909-1910 a new course extending over four years and leading to the Degree of B.A.Sc., came into operation, taking the place of the long established diploma course of three years, which came to an end in the Session 1910-1911. In the session 1923-24 the degree was changed to B. Arch. for the students graduating in Architecture.

SECTION V. ADMISSION AND REGISTRATION

Inquiries about admission to this Faculty should be sent to the Registrar of the University.

GENERAL

1. Candidates for admission in 1947 to the Faculty of Applied Science and Engineering must submit the certificates listed below as evidence that they are qualified to take one of the courses of instruction and proceed to a degree. Applicants must also submit a certificate of good character, and must have completed the seventeenth year of their age. The procedure for application and registration is described in paragraph 8 below.

2. In general, the holding of any of the following classes of certificate will constitute qualification for admission to this Faculty.

(*a*) The Ontario Secondary School Graduation Diploma in either the General Course or the Vocational Course (Industrial Department), and the Ontario Grade XIII certificate as described in paragraph 3 below.

(*b*) Certificates of having passed certain equivalent examinations as described in paragraph 5 below.

(*c*) Certificates of undergraduate work in other universities. See admission to advanced standing, paragraphs 6 and 7 below.

The Senate will consider applications for the recognition of certificates other than those mentioned as occasion may require. Such certificates must be accompanied by an official statement of the marks in the various subjects upon which the certificate was granted.

3. SECONDARY SCHOOL GRADUATION DIPLOMA

No subjects are definitely prescribed, but the diploma must show credit for **four** optional subjects.

GRADE XIII

ENGLISH
MATHEMATICS (Algebra, Geometry, Trigonometry)
SCIENCE (Chemistry and Physics)
One of FRENCH
GERMAN
GREEK
ITALIAN
LATIN
SPANISH

It is highly desirable that applicants for admission should have a good standing in Mathematics (Algebra, Geometry, Trigonometry).

A candidate applying to enter the course in Engineering Physics must have met the regular requirements for admission to the faculty and, in

addition, have obtained an average of seventy-five per cent. in Mathematics (Algebra, Geometry, and Trigonometry) of the Grade XIII examination. A candidate whose general proficiency record in other subjects is not considered by the Council to be sufficiently high will not be admitted.

A candidate applying to enter the course in Aeronautical Engineering must have met the regular requirements for admission to the Faculty, and, in addition, must have good standing in Mathematics and Science. A candidate whose general proficiency record in other subjects is not considered by the Council to be sufficiently high will not be admitted to the course.

4. Those intending to enter the course in Architecture are recommended to select French as one of the admission subjects; those intending to enter Chemical, Civil, Electrical, Mechanical, Metallurgical Engineering, or Engineering Physics are recommended to select German.

EQUIVALENT CERTIFICATES

5. Certificates of the following examinations recognized as equivalent in value to the Ontario Secondary School Graduation Diploma and Grade XIII certificate may be accepted in so far as they meet the admission requirements of the University of Toronto and conform to the admission requirements of the universities of the respective provinces. A candidate applying for admission on such certificates must submit an official statement of the marks upon which these certificates were awarded.

Province of Ontario

The Middle School Certificate now known as the Grade XII certificate or the Secondary School Graduation Diploma; the Upper School or Grade XIII certificate.

Province of Quebec

Quebec High School Leaving and Senior High School Leaving certificates; the Junior and Senior Matriculation certificates of McGill University.

Province of New Brunswick

Junior and Senior Matriculation certificates.

Province of Nova Scotia

High School certificates of Grade XI and Grade XII issued by the Department of Education.

Province of Manitoba

The Junior (Grade XI) and Senior (Grade XII) Matriculation certificates.

Province of British Columbia

The University Entrance or Junior Matriculation certificate and the Senior Matriculation certificate.

PROVINCE OF PRINCE EDWARD ISLAND

First Class License certificates issued by the Education Department or Honour Diplomas issued by the Prince of Wales College; Third Year certificates issued by the above College.

PROVINCE OF ALBERTA

The Junior (Grade XI) and Senior (Grade XII) Matriculation certificates.

PROVINCE OF SASKATCHEWAN

The Junior (Grade XI) and Senior (Grade XII) Matriculation certificates.

NEWFOUNDLAND

Junior and Senior Associate diplomas of the Department of Education.

NEWFOUNDLAND AND THE MARITIME PROVINCES

Certificates of the Common Examining Board.

GREAT BRITAIN

Certificate of having passed, or having exemption from the Preliminary Examination of the Institution of Civil Engineers in the British Isles, or equivalent.

ADMISSION TO ADVANCED STANDING

6. An undergraduate of another university may be admitted to advanced standing on such conditions as the Senate, on the recommendation of the Council of the Faculty, may prescribe.

7. An applicant for admission to advanced standing must submit with his application for admission: (1) an official transcript of his record in the University from which he wishes to transfer, showing in detail the courses which he has completed, with his standing in each; (2) certificate of honourable dismissal; (3) calendar of the university giving a full description of these courses.

PROCEDURE FOR APPLICATION AND REGISTRATION

8. Candidates for admission should apply to the Registrar of the University for forms of applications for admission; they are required to fill in these forms in duplicate and return them to the Registrar *not later than* September 1st, together with the following: (*a*) the Ontario Secondary School Graduation Diploma in the General Course and the Ontario Grade XIII certificate; (*b*) any other evidence of ability to take the work proposed; (*c*) certificate of good character. Failure to make early application will result in delay and inconvenience for the candidate.

9. Every person admitted to the University as an undergraduate must, at the time of his or her first medical examination by the University Health Service, present satisfactory evidence of successful vaccination, or must be vaccinated by the examining physician.

10. Every student must register in person with the Secretary of the Faculty as prescribed on page 5 of the Calendar.

11. A student who fails to register as prescribed in clause 10, must petition the Council for permission to register late. The Council, however, reserves the right to refuse the permission, or to impose a penalty, such penalty to be reckoned at one dollar per day, or part thereof, that elapses between the close of registration as prescribed and the filing of the petition.

12. A petition for permission to register late must be accompanied by a deposit equal to the estimated amount of the penalty. Should the Council decide that no penalty is to be imposed, the deposit will be refunded.

SECTION VI. FEES, DEPOSITS AND EXPENSES

FEES

1. A student who desires to enrol in the Faculty of Applied Science and Engineering is required to pay at least the First Term Instalment of fees on or before the opening date of the session, and before he can receive his registration card from the Secretary of the Faculty. The amount of the First Term Instalment of fees or of the Total Fee for the session may be ascertained from the schedule of fees below.

2. The Second Term Instalment of fees, if not already paid, is payable on or before January 15th. After this date an additional fee of $1.00 a month will be imposed until the whole amount is paid. All fees for the session must have been paid in full before the student can be admitted to the annual examinations.

3. In order to avoid delay in registration at the opening of the session it is recommended that at least the First Term Instalment of fees be forwarded by mail as early as possible in September, together with a form, in duplicate, to be provided by the Secretary of the Faculty and filled out by the student, giving his full name, course, year, etc.

4. University fees are payable at the Office of the Chief Accountant, Simcoe Hall, which will be open for the receipt of fees from 9 a.m. to 5 p.m. daily from September 15th to 24th (Saturday, September 20th, 9 a.m. to 12.30 p.m.), and from 9 a.m. to 1 p.m. daily except Saturday during the remainder of the session. Cheques in payment of these fees should be made payable to the University of Toronto at par in Toronto.

5. All University Fees payable by students enrolling for courses at Ajax are payable at "The Bursar's Office, Ajax Division, University of Toronto, Ajax, Ontario". All remittances should be made at par at either Toronto or Ajax, payable to "UNIVERSITY OF TORONTO, AJAX DIVISION".

Fees forms and remittances should be mailed to the Bursar's Office, Ajax, as early as possible in order that the forms may be returned in sufficient time for registration.

Provision will be made in the Bursar's Office, Simcoe Hall, Toronto, for receiving payment of fees from students registering for courses at Ajax during the week of registration of the first year September 15th-20th, 1947.

6. Each undergraduate enrolled in the Faculty of Applied Science and Engineering must pay annual fees to the Chief Accountant according to the schedule below; the total fee in each case is made up of the academic fee and incidental fees; all incidental fees are payable in the first term.

SCHEDULE OF FEES

Academic Year	*Academic Fee	†Incidental Fees	Total Fee (if paid in one instalment)	First Term Instalment	Second Term Instalment
Men					
First, Second, Third, Fourth (Architecture)...	$250	$41	$291	$166	$128
Fourth (final year), Fifth.....	250	51	301	176	128
Women					
First, Second, Third, Fourth (Architecture)...	$250	$27	$277	$152	$128
Fourth (final year), Fifth....	250	24	274	149	128

OTHER UNIVERSITY FEES

7. Each student is required to pay to the Chief Accountant at the opening of the session, or as otherwise specified, such of the following fees as may be required of him.

EQUIVALENT CERTIFICATE FEE

8. Each student who has been admitted to the First Year upon a certificate or certificates granted outside the Province of Ontario and covering all or any part of the admission requirements, must pay a fee of $5.00.

ADVANCED STANDING FEE

9. Each student who has been admitted to advanced standing from another university or college, must pay a fee of $10.00.

SUPPLEMENTAL PHYSICAL TRAINING FEE

10. Each student who has neglected to complete satisfactorily the course in Physical Training of the First or Second Year, and who must take this work during the Second or Third Years respectively of his or her attendance, must pay a fee of $10.00.

SUPPLEMENTAL EXAMINATION FEES

11. Each candidate for a supplemental examination is required to pay a fee to the Chief Accountant not later than September 1st. The fee is $10.00 for either one or two supplemental examinations, including laboratory supplementals. For each supplemental examination in a laboratory subject requiring special supervision, there is an additional fee of $10.00. The additional laboratory supplemental fee should not be paid until the candidate is notified by the Secretary.

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*The Academic Fee includes the following fees:—
Tuition; Library, Laboratory Supply; and one Annual Examination.

†These Incidental Fees include the following fees:—
For men—Degree (for the final year only); Hart House; Students' Administrative Council; Athletic; Health Service; Physical Training; Engineering Society; Faculty Athletic Association; and Laboratory Deposit.
For women—Degree (for final year only); Students' Administrative Council; Athletic; Health Service, Physical Training (for the First Year only); and Engineering Society; and Laboratory Deposit.

DEGREE FEE

12. Each candidate for the degree of Bachelor of Applied Science or Bachelor of Architecture must pay a fee of $10.00 to the Chief Accountant on or before the opening date of the session.

LABORATORY DEPOSIT

13. A laboratory breakage deposit of $10 is included in the incidental fees. This deposit, less charges for waste, neglect, and breakages will be refunded at the end of the session. Should the deposit be insufficient to meet the charges, a levy will be made to cover the deficiency.

SUMMARY OF STUDENTS' EXPENSES

14. The following approximate statement of expenses will give the student a general idea of the cost of obtaining an education in the Faculty of Applied Science and Engineering in the University of Toronto, exclusive of personal expenses:—

1. Fees, see schedule, page 29.
2. Board and Lodging, per week .... $10 up
3. Books and instruments, per year............... $50 to $60

SECTION VII. COURSES AND DEGREES

1. At the time of registration in the Faculty, the applicant is required to indicate the graduating course in which he intends to proceed to a degree. There are ten courses in Engineering, and the School of Architecture, from which the selection may be made, viz.,

Civil Engineering (Course 1),
Mining Engineering (Course 2),
Mechanical Engineering (Course 3),
Architecture (Course 4),
Engineering Physics (Course 5),
Chemical Engineering and Applied Chemistry (Course 6),
Electrical Engineering (Course 7),
Metallurgical Engineering (Course 8).
Ceramic Engineering (Course 8a).
Mining Geology (Course 9),
Aeronautical Engineering (Course 10).
Engineering and Business (Course 11).

2. The Degree of Bachelor of Applied Science will be awarded to students who complete one of the courses in Engineering, and Bachelor of Architecture to those who complete the course in Architecture.

3. The courses in Engineering extend over four academic years; the course in Architecture extends over five. A student must pass in the work of each academic year before proceeding to the work of the next. See Sec. X.

4. If, for any reason, an undergraduate wishes to change his course, he must petition the Faculty Council and obtain its approval. Such petition should be submitted by September 15, 1947.

5. Students must conform to all lecture room and laboratory regulations. Reports, briefs, theses, and drawings become the property of the Council to dispose of as it may see fit. Drawings, briefs, and field notes will not be accepted unless they have been made at the time and place provided in the time-table.

6. The curricula of the courses of instruction in Engineering and Architecture are given in Sec. IX.

7. Examinations are conducted as explained in Sec. X.

8. Students in Civil Engineering, Mining Engineering, Mechanical Engineering, Architecture, Electrical Engineering, and Mining Geology and Engineering and Business are required to have practical experience in offices, shops, or field, before their degree is granted. Students are asked to submit certificates of this experience as soon as possible after the completion of each period of work. (See Sec. IX.)

GRADUATE AND PROFESSIONAL DEGREES

1. Graduates in Engineering or Architecture may proceed to post-graduate and professional degrees. The post-graduate degrees are M. Arch., M.A.Sc., and Ph.D. The professional degrees are C.E , Chem. E., E.E., M.E. (Mechanical Engineer), M.E. (Mining Engineer), and Met. E.

2. Bursaries and scholarships for graduate students are available in limited number as shown on page 158. Many part-time demonstrator-shipsa re open which permit post-graduate work towards a degree.

3. The courses for these degrees are under the direction of the School of Graduate Studies, and candidates should send their inquiries to the Secretary of the School of Graduate Studies. Page 219 of this Calendar contains further information on graduate studies in Applied Science and Engineering.

ASSOCIATIONS OF PROFESSIONAL ENGINEERS

Graduation from the Faculty of Applied Science and Engineering leads to registration as a Professional Engineer in the various Associations of Professional Engineers throughout Canada.

SECTION VIII. SCHOOL OF ENGINEERING RESEARCH

THE SCHOOL

A School of Engineering Research, within the Faculty of Applied Science and Engineering, was established in the Spring of 1917 at the suggestion of the late Dean Ellis.

The School is under the direct supervision of a Committee of Management composed of members of the Faculty Council. To this Committee of the Council is entrusted the selection of researches to be undertaken under the auspices of the School, and the disposition of funds for conducting them.

The School was organized chiefly for the training of graduates in methods of research and for the carrying out of investigations. These latter may be problems relating to specific industries of raw materials and having a specific end in view, or general problems having to do with fundamental principles.

RESEARCH ASSISTANTS

A number of research assistants in the School of Engineering Research are appointed annually on salary in the various departments of the Faculty to carry on the work of research under direction of members of the staff. This work is accepted as partial fulfilment of the requirements for the degrees of M.A.Sc., M.Arch., and Ph.D. These research assistants are usually recent graduates, and are chosen from among those who have displayed special capacity for investigation in their undergraduate courses. Applicants should consult with members of the staff as soon as possible after the April examinations.

The facilities of the School are also open to graduates who desire to penetrate more deeply into particular phases of experimental work, or to undertake investigations either suggested by members of the staff or arising from their own work since graduation.

INQUIRIES

All communications should be sent to the Secretary of the Committee of Management, Mr. W. S. Wilson.

SECTION IX. CURRICULUM

The courses of instruction are designed to give the student a thorough grounding in the fundamentals of engineering or architecture, and, in addition, sufficient familiarity with the practical application of the principles to make him useful upon graduation. The courses are very similar in the First Year with the exception of those of Architecture, Engineering Physics, and Aeronautical Engineering. In the succeeding years specialization develops to some extent with provision in the Third and Fourth years for optional subjects in some of the graduating courses.

In the teaching of fundamentals, instruction is not confined wholly to Applied Science. As the future engineer is vitally concerned with the development of the country, it is essential that he be instructed in the rudiments of economics, administration, and business, which, with his scientific training, will enable him to increase his usefulness to the full.

Recognizing the growing emphasis of outstanding engineers and of the great professional organizations on the importance of breadth in engineering education, this Faculty liberalized its curricula in engineering and architecture, effective with the session 1944-45. The subjects that are considered to belong to the liberal stem, involving about 6 per cent of the total time of four undergraduate years, are the following: First Year English, and Engineering and Society; Second Year Economics; Third Year Modern World History, and Introduction to Political Science; Fourth Year Modern Political and Economic Trends, Philosophy of Science, and The Profession of Engineering.

Care has been taken to co-ordinate the liberal studies of the curriculum in such a manner as to form an integrated whole. Each derives support from those that have gone before and is the better understood by reason of them.

While a knowledge of these subjects does not form a part of the technical equipment of the engineer, it does add markedly to his ability to function as a broadly educated and effective citizen and thereby advances the prestige of his profession and himself in the mind of the general public.

The student who thoughtfully attends to what is offered in this so-called humanistic-social programme and follows it by self-directed reading and reflection will without question add notably to his qualifications for ultimate professional leadership. He will be the better able to discharge the double obligation laid upon him—to perform his technical duties efficiently and honourably and equally to contribute to the political, social, and cultural welfare of the community and country in which he lives.

In some graduating courses, laboratory work in the Fourth Year consists of the investigation of some specific problem. In all instances the student's knowledge of the original literature and primary sources of information is extended, and he is given a very desirable and useful training

in methods of research. In this way the undergraduate course is linked with the graduate courses (page 219), and with the work of the School of Engineering Research (page 33).

As part of the laboratory instruction, excursions to places of technical interest, both in Toronto and elsewhere, are arranged by the staff. These excursions are treated as laboratory periods with the same requirements as to attendance and reports. The total transportation costs in any one year will probably not exceed ten dollars.

On the following pages of this section, the curriculum for each course is set forth in detail. The time devoted to lectures and practical work is indicated as accurately as possible, but is subject to modification as occasion may require. The program and regulations regarding the courses of study and examination, contained in this Calendar, hold good for this academic year only, and the Faculty of Applied Science and Engineering does not bind itself to adhere for the whole period of a student's course to the conditions here laid down.

Communications relating to curricula, instruction, and examinations in the Faculty of Applied Science and Engineering should be sent to the Secretary of the Faculty.

For information regarding the courses of study leading to the post-graduate degrees, Master of Applied Science, Master of Architecture, and Doctor of Philosophy, see pages 219 and 220 of this calendar, and the calendar of the School of Graduate Studies, which gives full particulars.

CIVIL ENGINEERING

(Course 1)

The normal course in Civil Engineering has been so designed as to be broad and comprehensive, with a view to meeting not only the needs of those who have definitely decided to enter this branch of the profession, but also of those who desire a technical training of such a basic character as to enable them to enter various other fields of technical employment. Concurrent with the instruction in engineering subjects, sufficient attention is given to economic, legal, and administrative matters to make the graduate in this course fitted to enter not only upon such work as Municipal Engineering, Sanitary Engineering, Highway Engineering, Railway Engineering, Geodetic Surveying, Structural Engineering, and Hydraulic Engineering, but also upon administrative and executive work in both engineering and industrial undertakings.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Analytical Geometry, 492, page 136.

PRACTICAL EXPERIENCE

Before receiving the degree, every student in Civil Engineering is required to submit satisfactory evidence of having had at least 600 hours of practical experience. (See subject 690).

GRADUATE STUDY

Graduates of this University, or of other universities of comparable standing, who have taken the above mentioned or similar course with sufficiently high records may proceed with work leading to a graduate degree.

The time devoted to graduate study is divided between work on the subjects of mathematics, physics, fundamentals of civil engineering and related work on the approved civil engineering field of investigation chosen by the candidate.

Further information appears on page 219. The Calendar of the School of Graduate Studies should be consulted for details.

FIRST YEAR SUBJECTS COURSE 1	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry........	492 275	1	1	2	1
Calculus....................	490, 275	2	2	2	2
Chemistry..................	221, 222	2	–	2	6
Descriptive Geometry.......	270	1	–	1	–
Dynamics...................	21, 275	1	1	2	1
Electricity................	330	2	–	2	–
Engineering and Society.....	322	1	–	1	–
Engineering Problems and Drawing..............	275	–	9	–	4
English....................	610	1	–	1	–
Physical Training...........	640	–	2	–	2
Practical Experience.........	690	–	–	–	–
Statics.....................	20, 275	1	1	2	1
Surveying..................	710, 712	1	3	–	–

SECOND YEAR SUBJECTS COURSE 1	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Alternating Currents........	331, 350	1	–	1	3
Applied Physics.............	75, 76	1	3	1	3
Calculus....................	491	2	–	2	–
Descriptive Geometry.......	272	1	–	1	–
Dynamics...................	22	1	–	1	–
Economics..................	311	2	–	2	–
Engineering Chemistry.......	226	1	–	1	–
Engineering Problems and Drawing................	284	–	8	–	8
Hydraulics, Elementary......	447	1	–	–	–
Least Squares..............	494	–	–	1	–
Mechanics of Materials......	23, 31	2	–	2	3
Physical Training...........	640	–	2	–	2
Practical Astronomy........	200	–	–	2	–
Practical Experience.........	690	–	–	–	–
Spherical Trigonometry......	493	1	–	–	–
Surveying..................	714, 716	1	8	1	–

Third Year Subjects Course 1	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Applied Elasticity	33	1	–	1	–
Astronomy and Geodesy	201	–	–	2	–
Business	310	–	–	1	–
Cements and Concrete	35, 44	1	2	1	–
Construction Surveying	717	1	–	1	–
Descriptive Geometry	274	1	–	–	–
Differential Equations	507	1	1	1	1
Elementary Structural Engineering	28	2	–	2	–
Engineering Problems and Drawing	291	–	10	–	9
Engineering Geology	385, 386	1	–	2	2
Heat Engines, Theory	427, 428	1	–	1	2
Hydraulics	440, 441	2	–	2	3
Lithology	592	1	1	–	–
Machinery	463, 464	2	3	–	–
Modern World History	324	1	–	1	–
Photographic Surveying	81	1	–	–	–
Physical Metallurgy	546	–	–	1	–
Political Science	323	1	–	1	–
Practical Experience	690	–	–	–	–
Survey Camp	720	–	–	–	–

Before entering the Fourth Year, all students must select which one of the five elective subjects they propose to study. Information regarding these subjects will be given at the end of the Third Year. Although required to take an examination in only one of the five subjects, students are encouraged to attend lectures in the subjects other than the ones they select, when this is possible.

FOURTH YEAR SUBJECTS COURSE 1	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Contracts and Specifications..	315	–	–	1	–
Engineering Economics......	313	–	–	1	–
Engineering Law............	314	1	–	–	–
Foundations................	39, 298	1	–	1	2
Hydraulics.................	445, 446	1	3	1	–
Management...............	316	1	–	1	–
Mechanics of Materials Lab...	38, 50	–	3	–	6
Modern Political and Economic Trends........	325	1	–	1	–
Philosophy of Science........	326	1	–	½	–
Practical Experience.........	690	–	–	–	–
Profession of Engineering.....	327	–	–	½	–
Soil Mechanics..............	40	1	–	–	–
Reinforced Concrete.........	41, 298	1	6	1	6
Structural Design...........	43, 298	2		1	
Theory of Structures........	36, 298	1		1	
Thesis.....................	730	–	3	–	3
And *one* of the following Elective Subjects:					
1a. Advanced Structural Engineering..........	34, 37,	2	5	2	4
1b. Advanced and Photographic Surveying.....	82, 83, 718, 719	2	5	2	4
1c. Municipal Engineering....	215, 301, 306	2	5	2	4
1d. Transportation Engineering...........	216	2	5	2	4
1e. Water Power Engineering.	217, 444	2	5	2	4

MINING ENGINEERING

(COURSE 2)

The course in Mining Engineering, which originated in 1878 as a course in Assaying and Mining Geology, is intended to serve as a preliminary training for those who expect to practise in some branch of Mining Engineering, such as exploration of mining areas and primary development; mine surveying; mining processes involving civil, mechanical and electrical work; underground operations; mining machinery and operation; milling and treatment of ores; assaying and other forms of analysis and research; and administrative work in both engineering and industrial undertakings.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Analytical Geometry, 492, page 136.

PRACTICAL EXPERIENCE

Before receiving the degree, every student in Mining Engineering is required to present satisfactory evidence of having had at least six months' practical experience. (See subject 691.)

GRADUATE STUDY

Graduates of this University, or of another university of comparable standing, who have taken the above course with a sufficiently good standing may proceed with work leading to a graduate degree.

The major portion of the student's time will be devoted to research work on some subject approved by the Department, but certain specified courses of instruction must also be taken, in which examinations are demanded.

Further information appears on page 219 of this Calendar. The Calendar of the School of Graduate Studies should be consulted for details.

FIRST YEAR SUBJECTS COURSE 2	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry	492	1	–	2	–
Calculus	490	2	–	2	–
Chemistry	221, 222	2	6	2	6
Descriptive Geometry	270	1	–	1	–
Dynamics	21	1	–	2	–
Electricity	330	2	–	2	–
Engineering and Society	322	1	–	1	–
Engineering Problems and Drawing	276	–	6	–	6
English	610	1	–	1	–
Mechanical and Thermal Measurements	448	1	–	1	–
Mineralogy, Elementary	580, 581	–	–	2	1
Mining Laboratory	165	–	2	–	–
Physical Training	640	–	2	–	2
Practical Experience	691	–	–	–	–
Statics	20	1	–	2	–
Surveying	710, 712	1	3	–	–

SECOND YEAR SUBJECTS COURSE 2	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Alternating Currents	331, 350	1	–	1	3
Analytical Chemistry Laboratory	227	–	–	–	3
Blowpipe Analysis	587	–	2	–	–
Descriptive Geometry	272	1	–	1	–
Economics	311	2	–	2	–
Engineering Problems and Drawing	285	–	8	–	8
General Geology	388, 389	2	–	1	2
Heat Engines, Elementary	420	1	–	–	–
Lithology	585	1	–	–	1
Mechanics of Materials	23, 31	2	–	2	3

SECOND YEAR SUBJECTS COURSE 2—*Continued*	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Mining	167	1	–	–	–
Optical Mineralogy, Elementary	589	–	–	1	–
Organic Chemistry	250	1	–	1	–
Physical Training	640	–	2	–	2
Practical Experience	691	–	–	–	–
Problems and Seminar	186	–	2	–	–
Surveying	715, 716	1	6	1	–
Theory of Measurements	182	1	–	–	–

THIRD YEAR SUBJECTS COURSE 2	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Chemistry	225, 237	1	4	1	3
Assaying	160, 161	1	3	1	3
Business	310	–	–	1	–
Economic Geology	399	1	–	2	–
Electrical Machinery	348	2	–	–	–
Elementary Structural Engineering	29	1	–	1	–
Engineering Problems and Drawing	292	–	3	–	–
Geological Field Work	380	–	–	–	–
Hydraulics	440, 441	2	1½	–	–
Introductory Research	183	–	–	–	3
Metallurgy	530	1	–	–	–
Mining	170	1	–	1	–
Modern World History	324	1	–	1	–
Ore Dressing	175, 176	–	–	2	6
Petrology Laboratory	590	–	–	–	2
Physical Metallurgy	546, 549	–	–	1	1
Political Science	323	1	–	1	–
Practical Experience	691	–	–	–	–
Principles of Ore Dressing	181	2	–	–	–
Problems and Seminar	186	–	2	–	–
Structural Geology	390, 391	2	3	–	3
Summer Letters	184	–	–	–	–
Survey Camp	720	–	–	–	–

FOURTH YEAR SUBJECTS COURSE 2	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Engineering Economics	313	–	–	1	–
Geology, Precambrian	392	2	–	–	–
Geology, Mining	396	–	–	2	–
Geology, Pleistocene and Physiographic	381, 382	1	1	1	–
Heat Engines, Theory	427, 428	1	1½	1	–
Hydraulics	451	–	–	1	–
Machine Design	469, 470	1	–	1	3
Metallurgy	538, 539	1	–	1	3
Mine Management	172	2	–	–	–
Mine Ventilation	173, 174	2	3	–	–
Mining	166, 171	–	–	2	6
Modern Political and Economic Trends	325	1	–	1	–
Ore Dressing	177, 178	1	6	1	–
Practical Experience	691	–	–	–	–
Profession of Engineering	327	–	–	½	–
Problems and Seminar	186	–	2	–	–
Philosophy of Science	326	1	–	½	–
Summer Essays	185	–	–	2	–
Thesis	731	–	6½	–	5

MECHANICAL ENGINEERING

(Course 3)

The mechanical engineer is concerned with the production and the use of power; and it is part of his work to design and manufacture suitable machinery for this purpose, and to install and operate it. The internal combustion engine and the steam turbine are the products of his effort, and he applies these prime movers to automobiles, aeroplanes, locomotives, and other purposes. His work also includes the design of water turbines and their use in hydro-electric systems.

Other branches of his work are the making of designs for air compressors, machine tools, pumps, refrigerating machines and their application to storage warehouses and ice-making, heating and ventilating equipment, materials-handling and conveying plants, and generally all mechanical work. General industrial and administrative problems are considered.

The course of study has been devised to equip men for work in the general field of mechanical and industrial engineering.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Analytical Geometry, 492, page 136.

SHOP WORK

Before receiving the degree, every student in Mechanical Engineering is required to spend 1200 hours in mechanical shops, either prior to entering or during the vacations. (See subject 692.)

GRADUATE STUDY

Graduates of this University, or of another university of comparable standing, who have taken the above course, or one similar, with a sufficiently good standing may proceed with work leading to a graduate degree.

Some part of the instructional period will be devoted to advanced work in Mathematics and the Fundamentals of Engineering. The remainder of the time will be given to a study of some specific branch of Mechanical Engineering work or to some definite Mechanical problem.

Further information appears on page 219. The Calendar of the School of Graduate Studies should be consulted for details.

FIRST YEAR SUBJECTS COURSE 3	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry	492, 277	1	1	2	1
Calculus	490, 277	2	2	2	2
Chemistry	221, 222	2	6	2	–
Descriptive Geometry	270	1	–	1	–
Dynamics	21, 277	1	1	2	1
Electricity	330	2	–	2	–
Engineering and Society	322	1	–	1	–
Engineering Problems and Drawing	277	–	3	–	10
English	610	1	–	1	–
Mechanical and Thermal Measurements	448	1	–	1	–
Physical Training	640	–	2	–	2
Practical Experience	692	–	–	–	–
Statics	20	1	1	2	1
Surveying	710, 712	1	3	–	–

SECOND YEAR SUBJECTS COURSE 3	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Calculus	491	2	–	2	–
Descriptive Geometry	272	1	–	1	–
Direct Current Machines	338	–	–	2	3
Dynamics	22	1	–	1	–
Economics	311	2	–	2	–
Electricity	332, 334	2	3	–	–
Engineering Chemistry	226	1	–	1	–
Engineering Problems and Drawing	286	–	8	–	12
Heat Engines, Elementary	420	1	–	1	–
Hydraulics, Elementary	447	1	–	–	–
Mechanical Engineering	461	2	–	–	–
Mechanics of Materials	23, 31	2	3	2	–
Physical Training	640	–	2	–	2
Practical Experience	692	–	–	–	–
Theory of Machines A	465	2	–	2	–
Treatment of Technical Data	449	–	–	2	–

THIRD YEAR SUBJECTS COURSE 3	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Alternating Current Machinery	345	–	–	2	–
Alternating Currents........	340	2	–	–	–
Business..................	310	–	–	1	–
Electrical Laboratory........	346	–	3	–	3
Elementary Structural Engineering.............	29, 293	1	3	1	3
Heat Engineering...........	422	2	–	2	–
Heat Engines, Theory.......	421, 423	2	3	2	3
Hydraulics.................	440, 441	2	–	2	3
Machine Design............	467, 468	2	9	2	6
Modern World History.......	324	1	–	1	–
Physical Metallurgy.........	533	–	–	2	–
Political Science............	323	1	–	1	–
Practical Experience.........	692	–	–	–	–
Theory of Machines B.......	466	2	–	–	–

FOURTH YEAR SUBJECTS COURSE 3	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Engineering Economics......	313	–	–	1	–
Engineering Law............	314	1	–	–	–
Heat Engine Laboratory.....	426	–	5	–	6
Heat Power Engineering.....	424	2	–	1	–
Heat Treatment of Iron and Steel...................	547, 548	1	–	1	1½
Hydraulics.................	442, 443, 444	2	5	3	6
Industrial Management......	318	1	–	1	–
Internal Combustion and Air-Craft Engines...........	425	1	–	1	–
Machine Design............	473, 474	2	5	2	6
Modern Political and Economic Trends........	325	1	–	1	–
Philosophy of Science........	326	1	–	½	–
Practical Experience.........	692	–	–	–	–
Profession of Engineering.....	327	–	–	½	–
Structural Engineering.......	46, 299	2	3	–	–
Thesis.....................	732	–	1	–	1

SCHOOL OF ARCHITECTURE

(COURSE 4)

The School of Architecture is one of the oldest in the British Empire. It was established in 1890 as a Department of the School of Practical Science, later the Faculty of Applied Science and Engineering. The School is fortunate in enjoying a close connection with the Ontario Association of Architects and the Royal Architectural Institute of Canada, both of which organizations offer medals and scholarships for competition in the School.

The School is one of the architectural schools in the Empire recognized by the Royal Institute of British Architects, which admits graduates to Associate Membership on application, without examination. The Ontario Association of Architects, through its Registration Board, accepts the degree in Architecture, coupled with a twelve months period of office experience with an architect, as qualification to practise the profession of Architecture in the Province of Ontario. As a matter of fact, few graduates commence practice without a continuation of their practical training, and a year or two years' travel or additional experience is recommended.

The scope of an architect's practice in the modern world is wide and varied. He may be called upon to design buildings ranging from houses to hospitals. He may be a town planner, and an expert on dwellings for the lowest income groups. He may be an industrial designer called upon to design anything from kettles to mass produced furniture. No one can be equally skilled in all these fields, and in his training the young architect will find greater weight given to one aspect than to another. He is trained primarily to be an architect and a designer of buildings. He may specialize later in any of the fields mentioned above.

It should be clear that to enter such a course the young student should come to the School of Architecture aware of what is ahead of him as another student would to Theology or Medicine. Great architecture can be produced only by an individual in which a highly developed artistic sense and a sound mathematical sense are happily combined. The prospective student should possess the imagination and creative ability required for the work in design. He must have an orderly mind and a reasonable proficiency in mathematics.

The student will usually know whether his mathematics are sufficiently good to take the engineering and scientific courses in the School of Architecture. On the artistic side he may, in some cases, not feel so sure and would like advice. This he may obtain by writing to the School of Architecture, or, better still, by asking for an appointment with a senior member of the Staff.

PRACTICAL EXPERIENCE

Before receiving the degree, every student in the School of Architecture is required to submit satisfactory evidence of having had 12 months' (1900 hours) practical experience. (See subject 693.)

FIRST YEAR SUBJECTS COURSE 4	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Studio	Lect.	Studio
Analytical Geometry	492	1	–	2	–
Calculus	490	2	–	2	–
Architectural Drawing	121	–	15	–	15
Building Construction	140	–	–	1	–
Descriptive Geometry	270	1	–	1	–
Elements of Arch. Form	118	1	–	1	–
Engineering and Society	322	1	–	1	–
Engineering Problems and Drawing	278	–	3	–	3
English	610	1	–	1	1
Freehand Drawing	131	–	2	–	2
History of Architecture	110	1	–	1	–
Physical Training	640	–	2	–	2
Practical Experience	693	–	–	–	–
Statics	20	1	–	2	–
Surveying	710, 712	1	3	–	–

SECOND YEAR SUBJECTS COURSE 4	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Studio	Lect.	Studio
Architectural Design	122	–	21	–	26
Colour	136	1	–	–	–
Descriptive Geometry	272	1	–	1	–
Economics	311	2	–	2	–
Freehand Drawing	132	–	2	–	2
History of Architecture	111	1	–	1	–
Mechanics of Materials	23	2	–	2	–
Modelling	137	–	2	–	2
Photography	77, 78	1	3	–	–
Physical Training	640	–	2	–	2
Practical Experience	693	–	–	–	–
Theory of Arch. Planning	128	1	–	1	–

THIRD YEAR SUBJECTS COURSE 4	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Studio	Lect.	Studio
Architectural Design........	123	–	$17\frac{1}{2}$	–	$20\frac{1}{2}$
Commercial Law............	312	1	–	1	–
Freehand Drawing..........	133	–	2	–	2
Functional Requirements of Buildings...............	115	1	–	1	–
Garden Design.............	116	$\frac{1}{2}$	–	–	–
History of Architecture A....	112	1	–	$\frac{1}{2}$	–
History of Architecture B....	113	2	–	1	–
History of Sculpture.........	120	1	–	–	–
Light and Acoustics.........	85, 86	1	2	1	2
Measured Drawings.........	147	–	–	–	–
Modelling..................	138	–	2	–	2
Modern World History.......	324	1	–	1	–
Political Science............	323	1	–	1	–
Practical Experience.........	693	–	–	–	–
Public Speaking............	320	1	–	1	–
Structural Design...........	30	2	3	2	3

FOURTH YEAR SUBJECTS COURSE 4	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Studio	Lect.	Stud io
Architectural Design........	124	–	24	–	24
Building Materials					
Stones..................	405	1	–	–	–
Ceramic................	569	1	–	1	–
Architectural Application..	141	–	–	1	–
Contracts and Specifications..	315	–	–	1	–
Foundations................	39	1	–	1	–
Freehand Drawing..........	134	–	2	–	2
History of Painting.........	119	1	–	1	–
Housing...................	130	1	–	–	–
Illumination Design.........	87, 88	1	1	1	1
Modern Political and Economic Trends........	325	1	–	1	–
Practical Experience.........	693	–	–	–	–
Outdoor Sketches...........	148	–	–	–	–
Sanitary Science............	142	1	–	1	–
Structural Design...........	42	1	3	1	3

FIFTH YEAR SUBJECTS COURSE 4	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Studio	Lect.	Studio
Architectural Design	125	–	30	–	$30\frac{1}{2}$
Architectural Economics	145	1	–	1	–
Heating and Air Conditioning	144	1	–	1	–
Philosophy of Science	326	1	–	$\frac{1}{2}$	–
Practical Experience	693	–	–	–	–
Professional Practice	143	1	–	1	–
Structural Design	47	1	3	1	3
Town Planning	117	1	–	1	–

ENGINEERING PHYSICS

(COURSE 5)

Admission to and promotion in this course is granted only to students who meet the special requirements set forth on pages 24 and 156 of this Calendar.

The course is designed to afford a training in Mathematics and Physics beyond that which it is possible to give in the other undergraduate courses in engineering. It is believed that a wider and more thorough acquaintance with the basic sciences will bring to the student a readier appreciation of the nature of the technical problems with which he will later be confronted and a greater facility in the solution of them. A course of the kind offered should consequently be of particular value to those who desire to enter governmental or industrial research laboratories, or who wish to engage in any original work of investigation or development in the field of applied physics.

Throughout the four years of the course an effort is made to maintain the practical point of view in the theoretical instruction. This is effected, in part, by adopting wherever possible the engineering viewpoint in the teaching of mathematical and scientific subjects, and, in part, by the inclusion of certain basic engineering instruction.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Algebra and Calculus, 502, page 137.

SECOND YEAR SUBJECTS COURSE 5	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Acoustics	654	1	–	–	–
Analytical Geometry of Space	506	1	–	1	–
Descriptive Geometry	272	1	–	1	–
Differential Calculus	504	3	–	3	–
Dynamics	22	1	–	1	–
Economics	311	2	–	2	–
Electricity	332, 334	2	3	–	–
Elementary Light	653	1	–	1	–
Elementary Magnetism and Electricity	652	1	–	2	–
Integral Calculus and Differential Equations	505	3	–	3	–
Machine Design	471, 472	1	3	1	3
Mechanics of Materials	23, 31	2	–	2	3
Organic Chemistry	250	1	–	1	–
Physics Laboratory	655	–	3	–	6
Physical Training	640	–	2	–	2

Students in Engineering Physics are required to state at the beginning of the Third Year the options they desire to pursue in the Third and Fourth Years. Permission to enter upon an option must be sought from the

THIRD YEAR SUBJECTS COURSE 5	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Differential Equations	509	1	1	1	1
Direct Current Machines	339	2	–	–	–
Heat	658	1	–	1	–
Mathematical Operations Applied to Physics	656	1	–	1	–
Modern World History	324	1	–	1	–
Physical Laboratory	659	–	3	–	3
Physical Metallurgy	533	–	–	2	–
Political Science	323	1	–	1	–
Properties of Matter	657	2	–	2	–
Theoretical Mechanics	520	1	1	1	1
Theory of Functions	508	1	1	1	1

And *one* of the following options which must be continued in the Fourth Year.

Option 5c, Electricity and Communications					
Option 5s, X-Rays and Spectroscopy					
Option 5i, Illumination and Acoustics					
Alternating Currents	341	2	–	2	–
Electrical Design	342	2	–	–	–
Electrical Laboratory	344	–	6	–	6
Geometrical Optics	660,661	1	3	–	–
Photometry	79,80	–	–	1	3
Electronics	337	–	–	3	–
Option 5g, Geophysics					
Alternating Currents	341	2	–	2	–
Electrical Laboratory	344	–	6	–	6
Engineering Geology	385,386	1	–	2	2
Lithology	585	1	–	–	1
Mineralogy, Elementary	580,581	2	1	–	–
Optical Mineralogy, Elementary	589	–	–	1	–

THIRD YEAR SUBJECTS COURSE 5	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Option 5r, Refrigeration					
Alternating Current.........	340	2	–	–	–
Electrical Laboratory........	347	–	3	–	3
Elementary Structural Engineering.............	29, 296	1	–	1	3
Properties of Living Matter...	210	2	–	2	–
Theory of Heat Engines......	421, 423	2	3	2	3

FOURTH YEAR SUBJECTS COURSE 5	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Option 5c, Electricity and Communications					
Acoustics	97	1	–	–	–
Acoustics, Advanced	664	1	–	–	–
Alternating Current Circuit Analysis	351	2	–	2	–
Communication	361, 362	2	3	2	3
Differential Equations of Mathematical Physics	521	2	–	2	–
Electrical Laboratory	356	–	6	–	6
Electrical Transmission of Energy	352	2	–	–	–
Electromagnetic Theory, Applied	365	2	–	2	–
Introduction to Atomic and Molecular Physics	663	1	–	1	–
Modern Political and Economic Trends	325	1	–	1	–
Operational Methods	364	2	–	2	–
Philosophy of Science	326	1	–	$\frac{1}{2}$	–
Physical Laboratory	665	–	3	–	3
Profession of Engineering	327	–	–	$\frac{1}{2}$	–
Thesis	733	–	–	–	–
Option 5s, X-Rays and Spectroscopy					
Acoustics	97	1	–	–	–
Acoustics, Advanced	664	1	–	–	–
Analysis of Materials by Spectrographic and X-ray Methods	669	1	–	1	–
Atomic and Molecular Spectra	667	1	–	1	–
Communication	361, 362	2	3	–	–
Differential Equations of Mathematical Physics	521	2	–	2	–
Electromagnetic Theory, Applied	365	2	–	2	–
Elementary Quantum Theory	668	1	–	–	–
Introduction to Atomic and Molecular Physics	663	1	–	1	–
Modern Political and Economic Trends	325	1	–	1	–
Morphological Crystallography	598	1	–	1	–

FOURTH YEAR SUBJECTS COURSE 5	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Option 5s, X-Rays and Spectroscopy (continued)					
Operational Methods	364	2	–	2	–
Optics, Advanced	666	1	–	1	–
Philosophy of Science	326	1	–	½	–
Physical Laboratory	665	–	9	–	12
Profession of Engineering	327	–	–	½	–
Thesis	733	–	–	–	–
Option 5g, Geophysics					
Differential Equations of Mathematical Physics	521	2	–	2	–
Economic Geology	398, 400	1	3	3	3
Electromagnetic Theory, Applied	365	2	–	2	–
Geophysics	670, 671	2	9	2	9
Location of Mineral Deposits	401	–	–	1	–
Modern Political and Economic Trends	325	1	–	1	–
Petrography	594, 595	1	–	1	–
Philosophy of Science	326	1	–	½	–
Physics of the Earth	672	2	–	2	–
Profession of Engineering	327	–	–	½	–
Structural Geology	390, 391	2	3	–	3
Thesis	733	–	–	–	–

FOURTH YEAR SUBJECTS COURSE 5	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Option 5i, Illumination and Acoustics					
Acoustics, Advanced........	664	1	–	–	–
Architectural Acoustics......	89,90	1	3	3	9
Communication.............	361, 362	2	3	–	–
Differential Equations of Mathematical Physics.....	521	2	–	2	–
Modern Political and Economic Trends........	325	1	–	1	–
Operational Methods........	364	2	–	2	–
Philosophy of Science........	326	1	–	½	–
Photometry and Illumination Design..................	95, 96	2	6	2	6
Physical Laboratory.........	674	–	3	–	3
Physics of Light Production..	673	2	–	–	–
Profession of Engineering.....	327	–	–	½	–
Option 5r, Refrigeration					
Alternating Current Machinery..............	353, 367	2	3	2	–
Differential Equations of Mathematical Physics.....	521	2	–	2	–
Electronics................	337, 368	–	–	3	3
Heat Power Engineering.....	424, 426	2	5	1	6
Heat Transfer and Refrigeration............	429	2	–	2	–
Internal Combustion Engines.	425	1	–	1	–
Low Temperature Physiology.	211, 212	1	3	1	3
Modern Political and Economic Trends........	325	1	–	1	–
Philosophy of Science........	326	1	–	½	–
Physics of Light Production..	673	2	–	–	–
Profession of Engineering.....	327	–	–	½	–
Thesis.....................	733	–	–	–	–
Vibration Engineering.......	99, 100	1	3	1	3

CHEMICAL ENGINEERING AND APPLIED CHEMISTRY

(COURSE 6)

The course is designed to give the student a thorough training in the underlying principles and laboratory methods of inorganic, organic, physical, and analytical chemistry, in the applications of these to industrial chemistry and chemical engineering, and a general knowledge of the elements of thermodynamics, hydraulics, machine design, structural design, electricity, and metallurgy. A preliminary training of this nature with subsequent practical experience will enable him to undertake the design and construction, also the operation and management of the plant required in such branches of chemical industry as are concerned with the production of chemical and pharmaceutical products, petroleum and its products, rubber goods, leather and glue, soap, meat products, foodstuffs, vegetable and animal oils, sugar, pulp and paper, vegetable and animal fibres, artificial silk, plastics, coal tar and wood distillates, paints and varnishes, explosives, dyes, portland cement, metals and their alloys, electrochemical products, fermentation products, fertilizers, synthetic chemical products, etc.

For those who by temperament and ability are attracted to chemical research there exist excellent opportunities in government, industrial, and medical research laboratories. Properly qualified students wishing to pursue experimental investigation as a life-work, whether in industrial chemistry or in purely scientific chemistry, may proceed in this department to the degrees M.A.Sc. and Ph.D., the laboratory research work of the Fourth Year serving as a connecting link between the undergraduate and graduate courses.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Analytical Geometry, 492, page 136.

GRADUATE STUDY

Graduates of this University, or of another university of comparable standing, who have taken the above course, or one similar, with a sufficiently good standing may proceed with work leading to a graduate degree.

Students wishing to pursue further studies, whether in chemical engineering, industrial chemistry, or in pure scientific chemistry, may proceed in the Department of Chemical Engineering to the degrees M.A.Sc. and Ph.D.

The major portion of the student's time will be devoted to research work assigned by the Department, but certain specified courses of instruction must be taken in which examinations are demanded.

Further information appears on page 219 of this Calendar. The Calendar of the School of Graduate Studies should be consulted for details.

First Year Subjects Course 6	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry	492	1	–	2	–
Calculus	490	2	–	2	–
Chemistry	221, 222	2	9	2	6
Descriptive Geometry	270	1	–	1	–
Dynamics	21	1	–	2	–
Electricity	330	2	–	2	–
Engineering and Society	322	1	–	1	–
Engineering Problems and Drawing	280	–	4	–	8
English	610	1	–	1	–
Mechanical and Thermal Measurements	448	1	–	1	–
Mineralogy, Introductory	583	–	–	1	1
Physical Training	640	–	2	–	2
Statics	20	1	–	2	–
Surveying	710, 712	1	3	–	–

Second Year Subjects Course 6	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Calculus	491	2	–	2	–
Chemical Laboratory	229	–	–	–	–
Economics	311	2	–	2	–
Electricity	332, 334	2	3	–	–
Elementary Machine Design	462	–	–	2	–
Engineering Problems and Drawing	287	–	3	–	6
German	613	1	–	1	–
Hydraulics, Elementary	447	1	–	–	–
Industrial Chemistry	230, 232	1	11	2	–

SECOND YEAR SUBJECTS COURSE 6—*Continued*	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Inorganic Chemistry	223	1	–	1	–
Mechanics of Materials	23	2	–	2	–
Organic Chemistry	234, 235	2	–	2	10
Physical Chemistry	236	2	–	2	–
Physical Training	640	–	2	–	2

THIRD YEAR SUBJECTS COURSE 6	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Alternating Currents	340, 349	2	3	–	–
Business	310	–	–	1	–
Chemical Engineering	242	2	–	–	–
Chemical Theory	240	–	–	2	–
Electrochemistry	246, 247	$1\frac{1}{2}$	$1\frac{1}{2}$	–	–
German	614	1	–	1	–
Heat Engines, Theory	421, 428	2	–	2	$1\frac{1}{2}$
Hydraulics	440, 441	2	$1\frac{1}{2}$	2	–
Industrial Chemistry	241, 238	1	–	1	$13\frac{1}{2}$
Metallurgy, Physical	546	–	–	1	–
Modern World History	324	1	–	1	–
Optics	72,73	1	–	1	3
Organic Chemistry	244, 245	2	12	2	–
Political Science	323	1	–	1	–

FOURTH YEAR SUBJECTS COURSE 6	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Chemical Engineering........	253	1	–	1	–
Chemical Engineering Problems................	252	–	–	–	2
Chemical Engineering Thermodynamics.........	248	1	–	1	–
Chemical Laboratory........	251	–	15	–	–
Chemical Theory...........	259	1	–	2	–
Engineering Law............	314	1	–	–	–
German....................	615	1	–	1	–
Graphical Methods in Chemical Engineering.....	254	–	1	–	1
Industrial Chemistry........	258	1	–	–	–
Industrial Management......	318	1	–	1	–
Machine Design............	469, 470	1	–	1	3
Modern Political and Economic Trends........	325	1	–	1	–
Organic Chemistry..........	249	1	–	1	–
Philosophy of Science........	326	1	–	½	–
Profession of Engineering....	327	–	–	½	–
Public Speaking............	320	1	–	1	–
Thesis....................	734	–	5	–	16

ELECTRICAL ENGINEERING

(COURSE 7)

In following his profession, an electrical engineer will find necessary a knowledge of many fields in addition to that of applying things electrical for the benefit of humanity. For this reason the course includes not only mathematics, mechanics, physics and chemistry, but also heat engines, hydraulics, theory of mechanisms, machine design, business, economics, engineering law, and other non-electrical subjects.

In the electrical field much time is given to the calculation of circuits of electric, magnetic, and dielectric types, methods of measurement of various quantities in direct and alternating current circuits, theory of generators, motors, magnets, and other apparatus, design, electrical transmission of energy, and many related matters of interest. A great variety of problems for solution is one means of developing understanding. In the Fourth Year the proportion of time given to electrical engineering is much greater than in earlier years.

A training of this nature should, with subsequent experience, enable a student to develop into a useful and valued member of the profession, whether his natural abilities lead him into technical, commercial, or administrative responsibilities.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Analytical Geometry, 492, page 136.

PRACTICAL EXPERIENCE

Before receiving the degree, every student in Electrical Engineering is required to submit satisfactory evidence of having had 1200 hours' practical experience. (See subject 695.)

GRADUATE STUDY

Graduates of this University, or of another university of recognized standing, who have taken the above course, or one similar, and who have a satisfactory academic record may proceed with work leading to a graduate degree.

About one-half of the time will be devoted to subjects chosen from mathematics, physics, and the fundamentals of electrical engineering. The other half may be devoted to power, electronics, or communications.

Further information appears on page 219. The Calendar of the School of Graduate Studies should be consulted for details.

FIRST YEAR SUBJECTS COURSE 7	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry	492	1	1	2	1
Calculus	490	2	2	2	2
Chemistry	221, 222	2	–	2	6
Descriptive Geometry	270	1	–	1	–
Dynamics	21, 281	1	1	2	1
Electricity	330	2	–	2	–
Engineering and Society	322	1	–	1	–
Engineering Problems and Drawing	281	–	9	–	4
English	610	1	–	1	–
Mechanical and Thermal Measurements	448	1	–	1	–
Physical Training	640	–	2	–	2
Practical Experience	695	–	–	–	–
Statics	20, 281	1	1	2	1
Surveying	710, 712	1	3	–	–

SECOND YEAR SUBJECTS COURSE 7	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Applied Physics	70,71	1	3	1	3
Calculus	491	2	3	2	3
Descriptive Geometry	272	1	–	1	–
Dynamics	22	1	–	1	–
Economics	311	2	–	2	–
Electrical Fundamentals	333	2	–	2	–
Electrical Laboratory	334	–	–	–	6
Electricity	332	–	–	2	–
Elementary Heat Engines	420	1	–	–	–
Elementary Machine Design	462	–	–	2	–
Engineering Chemistry	226	1	–	1	–
Engineering Problems and Drawing	288	–	6	–	3
Hydraulics, Elementary	447	1	–	–	–
Mechanics of Materials	23, 31	2	3	2	–
Physical Training	640	–	2	–	2
Practical Experience	695	–	–	–	–

THIRD YEAR SUBJECTS COURSE 7	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Alternating Currents	341	2	–	2	–
Business	310	–	–	1	–
Direct Current Machines	339	2	–	–	–
Electrical Design	342	2	6	–	–
Electrical Problems and Seminar	343	–	3	–	3
Electrical Laboratory	344	–	6	–	3
Electronics	337	–	–	3	–
Heat Engines, Theory	421, 423	2	3	2	–
Hydraulics	440, 441	2	–	2	3
Machine Design	475, 468	2	–	2	3
Mathematical Applications in Electrical Engineering	336	–	–	3	–
Modern World History	324	1	–	1	–
Physical Metallurgy	533	–	–	2	–
Political Science	323	1	–	1	–
Practical Experience	695	–	–	–	–

FOURTH YEAR SUBJECTS COURSE 7	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Acoustics	98	1	–	–	–
Alternating Current Circuit Analysis	351	2	–	2	–
Alternating Current Machinery	353	2	–	2	–
Alternating Current Measurements	354	2	–	–	–
Communication	361, 362	2	3	2	3
Electrical Design	358	–	–	1	3
Electrical Laboratory	355	–	6	–	6
Electrical Transmission of Energy	352	2	–	–	–
Engineering Economics	313	–	–	1	–
Engineering Electronics	357	1	–	2	–
Engineering Law	314	1	–	–	–
Illumination	93, 94	1	$1\frac{1}{2}$	1	$1\frac{1}{2}$
Industrial Management	318	1	–	1	–
Modern Political and Economic Trends	325	1	–	1	–
Philosophy of Science	326	1	–	$\frac{1}{2}$	–
Practical Experience	695	–	–	–	–
Profession of Engineering	327	–	–	$\frac{1}{2}$	–
Seminar	359	–	3	–	3
Thesis	735	–	–	–	–

METALLURGICAL ENGINEERING

(COURSE 8)

The metallurgical engineer is concerned with the winning of metals from ores. Since virgin metals rarely possess useful physical properties, the second task of the metallurgist is to produce alloys, such as steel, which have suitable physical properties.

No other materials approach the metals in strength, and the whole fabric of modern civilization is dependent on their properties. The fields of employment for graduates lie in production metallurgical industries, the industries which fabricate metals, and in sales and research. Metallurgical research facilities have notably been increased in recent years in Canada.

The course is designed to give the student a firm grasp of the chemical fundamentals upon which metallurgical reactions are based. Engineering courses are provided to give a general knowledge of hydraulics, mechanics of materials, etc.

Courses in production metallurgy cover the theory and practice of winning aluminium, copper, iron, lead, magnesium, nickel, zinc, etc., from their ores. Physical metallurgy courses cover the production, heat treatment, microscopic and physical examination of alloys.

The subjects of instruction are shown in the following pages. In these tables, reference numbers have been assigned to the subjects referring to a more detailed description of each, e.g., Analytical Geometry 492, page 136.

GRADUATE STUDY

Graduates of this University, or of another university of comparable standing, who have taken the above course, or one similar, with a sufficiently good standing, may proceed with work leading to a graduate degree.

Students wishing to pursue further studies, whether in extractive metallurgy or physical metallurgy, may proceed in the Department of Metallurgical Engineering to the degrees M.A.Sc. and Ph.D.

A major part of the time will be spent on research work, while the remainder will be devoted to subjects chosen from Physics, Chemistry, Mining, Mineralogy and Metallurgy.

Further information appears on page 219 and in the Calendar of the School of Graduate Studies.

FIRST YEAR SUBJECTS COURSE 8	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry	492	1	–	2	–
Calculus	490	2	–	2	–
Chemistry	221, 222	2	6	2	6
Descriptive Geometry	270	1	–	1	–
Dynamics	21	1	–	2	–
Electricity	330	2	–	2	–
Engineering and Society	322	1	–	1	–
Engineering Problems and Drawing	282	–	8	–	7
English	610	1	–	1	–
Mechanical and Thermal Measurements	448	1	–	1	–
Mineralogy, Introductory	583	–	–	1	1
Physical Training	640	–	2	–	2
Statics	20	1	–	2	–
Surveying	710, 712	1	3	–	–

SECOND YEAR SUBJECTS COURSE 8	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Alternating Currents	331,350	1	–	1	3
Analytical Chemistry Laboratory	228	–	9	–	9
Calculus	491	2	–	2	–
Economics	311	2	–	2	–
Electricity	332, 334	2	3	–	–
Elementary Machine Design	462	–	–	2	–
Engineering Problems and Drawing	289	–	3	–	3
Fuels and Combustion	531	1	–	1	–
Heat Engines, Elementary	420	1	–	–	–
Hydraulics, Elementary	447	1	–	–	–
Inorganic Chemistry	223	1	–	1	–
Mechanics of Materials	23	2	–	2	–
Metallurgy	530	1	–	–	–
Mining	168	1	–	1	–
Physical Chemistry	236	2	–	2	–
Physical Training	640	–	2	–	2

THIRD YEAR SUBJECTS COURSE 8	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Chemistry	225	1	–	1	–
Assaying	160, 161	1	3	1	3
Business	310	–	–	1	–
Electrical Machinery	348	2	–	–	–
Electrochemistry	246, 247	$1\frac{1}{2}$	3	–	–
Heat Engines, Theory	427, 428	1	–	1	$1\frac{1}{2}$
Metallography Laboratory	537	–	3	–	3
Metallurgical Theory	239	2	–	2	–
Metallurgy	534, 535	2	6	1	6
Modern World History	324	1	–	1	–
Ore Dressing	175, 176	–	–	2	6
Physical Metallurgy	536	2	–	2	–
Political Science	323	1	–	1	–
Principles of Ore Dressing	181	2	–	–	–

FOURTH YEAR SUBJECTS COURSE 8	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Electrochemistry	255, 256	1	–	1	3
Engineering Economics	313	–	–	1	–
Machine Design	469, 470	1	–	1	3
Metallography Laboratory	544	–	3	–	3
Metallurgical Theory	550	1	–	1	–
Metallurgy	541, 542	1	6	1	3
Metallurgy Problems	540	2	–	2	–
Modern Political and Economic Trends	325	1	–	1	–
Ore Dressing	177, 178	1	6	1	–
Philosophy of Science	326	1	–	$\frac{1}{2}$	–
Physical Metallurgy	543, 545	2	3	2	–
Plant Management	317	–	–	1	–
Profession of Engineering	327	–	–	$\frac{1}{2}$	–
Thesis	736	–	4	–	8

CERAMIC ENGINEERING

(COURSE 8a)

The course in Ceramics offers a training for those who intend to work as engineers in the ceramic and industrial mineral industries. Ceramics deals with the preparation of raw materials for, and the manufacture and use of, such products as refractories, cement, heavy clay products, porcelain, pottery, glass and enamelled iron. Industrial mineral engineering includes the beneficiation and commercial utilization of minerals, not primarily used for the production of metals. Such minerals include asbestos, clay, diatomite, feldspar, gypsum, limestone, mica, quartz, talc, etc.

In the manufacture of fused silicates, such as glasses, glazes and enamels, both clear and coloured and in the manufacture of special bodies such as those used for thermal and electrical insulation, practically every chemical element obtainable on a commercial basis may be used. The subject matter is essentially inorganic chemical engineering with an emphasis upon high temperature chemistry. The natural field of employment for graduates would be for the technical, production and sales divisions of the industry.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, e.g., Analytical Geometry 492, page 136.

GRADUATE STUDY

Graduates of this University, or of another university of comparable standing, who have taken the above course, or one similar, with a sufficiently good standing, may proceed with work leading to a graduate degree. A part of the time will be devoted to subjects chosen from physics, chemistry and others approved by the School of Graduate Studies, while the remainder will be devoted to research in the same phase of the ceramic field.

Further information appears on page 219. The Calendar of the School of Graduate Studies should be consulted for further details.

First Year Subjects Course 8a	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry........	492	1	–	2	–
Calculus....................	490	2	–	2	–
Chemistry.................	221, 222	2	9	2	6
Descriptive Geometry.......	270	1	–	1	–
Dynamics..................	21	1	–	2	–
Electricity................	330	2	–	2	–
Engineering and Society......	322	1	–	1	–
Engineering Problems and Drawing...............	283	–	5	–	7
English....................	610	1	–	1	–
Mechanical and Termal Measurements...........	448	1	–	1	–
Mineralogy, Introductory....	583	–	–	1	1
Physical Training...........	640	–	2	–	2
Statics.....................	20	1	–	2	–
Surveying.............. ...	710, 712	1	3	–	–

Second Year Subjects Course 8a	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Chemical Laboratory..............	228	–	9	–	9
Ceramics, Introductory......	572	2	–	–	–
Economics..................	311	2	–	2	–
Elementary Machine Design..	462	–	–	2	–
Electricity..................	332, 334	2	3	–	–
Elementary Light...........	653	1	–	1	–
Engineering Problems and Drawing................	290	–	3	–	6
Fuels and Combustion.......	531	1	–	1	–
Hydraulics, Elementary......	447	1	–	–	–
Industrial Chemistry	230	1	–	2	–
Inorganic Chemistry.........	223	1	–	1	–
Mechanics of Materials......	23	2	–	2	–
Organic Chemistry..........	250	1	–	1	–
Physical Chemistry.........	236	2	–	2	–
Physical Training...........	640	–	2	–	2

THIRD YEAR SUBJECTS COURSE 8a	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Alternating Currents	340, 349	2	3	–	–
Assaying Laboratory	164	–	$1\frac{1}{2}$	–	–
Business	310	–	–	1	–
Ceramics	562	–	–	2	–
Ceramics Laboratory	564	–	$6\frac{1}{2}$	–	7
Chemical Engineering	242	2	–	–	–
Chemical Theory	240	–	–	2	–
Elementary Structural Engineering	29	1	–	1	–
Engineering Problems and Drawing	297	–	3	–	3
Heat Engines, Theory	421, 428	2	–	2	$1\frac{1}{2}$
Modern World History	324	1	–	1	–
Non-Metallic Minerals	560, 561	3	6	2	6
Optical Mineralogy, Elementary	589	–	–	1	–
Physical Metallurgy	533	–	–	2	–
Political Science	323	1	–	1	–

FOURTH YEAR SUBJECTS COURSE 8a	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Ceramic Calculations	563	1	–	–	–
Economic Geology	402	–	–	2	–
Glass and Enamels	566	1	–	1	–
Hydraulics	440, 441	2	3	–	–
Industrial Management	318	1	–	1	–
Industrial Minerals Laboratory	568	–	6	–	6
Machine Design	469, 470	1	–	1	3
Modern Political and Economic Trends	325	1	–	1	–
Optical Mineralogy Laboratory	596	–	2	–	2
Ore Dressing Laboratory	180	–	3	–	3
Philosophy of Science	326	1	–	$\frac{1}{2}$	–
Plant Design	300	–	–	–	3
Principles of Ore Dressing	181	2	–	–	–
Profession of Engineering	327	–	–	$\frac{1}{2}$	–
Refractories and Ceramic Bodies	565	1	–	2	–
Thesis	737	–	6	–	6

MINING GEOLOGY

(COURSE 9)

The course in Mining Geology is designed to train more particularly those who wish to enter the field of applied geology, but it is sufficiently broad to provide training for work in any branch of geology, unless it be that in which an extensive knowledge of palaeontology is necessary.

The economic geologist is frequently brought into contact with engineering problems and it is essential that he receive a good grounding in those subjects, such as mathematics, mechanics, chemistry, physical sciences, surveying, and engineering drawing, that constitute the preliminary work in engineering courses. It is necessary that he understand something of the language and methods of the mining, metallurgical, and construction engineer with whom he must co-operate in his work around mines, dams, and other engineering works. The first two years of this course are the same as those in Mining Engineering, since that course provides the essential preliminary work, and some mining and metallurgy are taken in the other years to broaden the knowledge of the geologist in the work of those with whom he must co-operate.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Analytical Geometry, 492, page 136.

PRACTICAL EXPERIENCE

Before receiving the degree every student in Mining Geology, is required to submit satisfactory evidence of having had six months' practical experience. (See subject 696.)

GRADUATE STUDY

Graduates in the above course, or in a similar one in any university with standards comparable to this University, with a sufficiently good standing, may proceed with work leading to a higher degree.

Work for such degree will include the preparation of a thesis on an approved subject, together with the study of such subjects as advanced structural geology, economic geology, mining, metamorphism, and geophysics.

Further information appears on page 219. The Calendar of the School of Graduate Studies should be consulted for details.

FIRST YEAR SUBJECTS COURSE 9	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry	492	1	–	2	–
Calculus	490	2	–	2	–
Chemistry	221, 222	2	6	2	6
Descriptive Geometry	270	1	–	1	–
Dynamics	21	1	–	2	–
Electricity	330	2	–	2	–
Engineering and Society	322	1	–	1	–
Engineering Problems and Drawing	276	–	6	–	6
English	610	1	–	1	–
Mechanical and Thermal Measurements	448	1	–	1	–
Mineralogy, Elementary	580, 581	–	–	2	1
Mining Laboratory	165	–	2	–	–
Physical Training	640	–	2	–	2
Practical Experience	696	–	–	–	–
Statics	20	1	–	2	–
Surveying	710, 712	1	3	–	–

SECOND YEAR SUBJECTS COURSE 9	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Chemistry Laboratory	227	–	–	–	3
Alternating Currents	331, 350	1	–	1	3
Blowpipe Analysis	587	–	2	–	–
Descriptive Geometry	272	1	–	1	–
Economics	311	2	–	2	–
Engineering Problems and Drawing	285	–	8	–	8
General Geology	388, 389	2	–	1	2
Heat Engines, Elementary	420	1	–	–	–
Lithology	585	1	–	–	1
Mechanics of Materials	23,31	2	–	2	3

SECOND YEAR SUBJECTS COURSE 9—*Continued*	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Mining	167	1	–	–	–
Optical Mineralogy, Elementary	589	–	–	1	–
Organic Chemistry	250	1	–	1	–
Physical Training	640	–	2	–	2
Practical Experience	696	–	–	–	–
Problems and Seminar	186	–	2	–	–
Surveying	715, 716	1	6	1	–
Theory of Measurements	182	1	–	–	–

THIRD YEAR SUBJECTS COURSE 9	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Chemistry	225, 237	1	4	1	3
Assaying	160, 161	1	3	1	3
Business	310	–	–	1	–
Economic Geology	398, 400	1	3	3	3
Geological Field Work	380	–	–	–	–
Historical Geology	383, 384	2	2	2	2
Metallurgy	530	1	–	–	–
Mining	170	1	–	1	–
Modern World History	324	1	–	1	–
Petrography	594, 595	1	2	1	2
Physical Chemistry	236	2	–	2	–
Physical Metallurgy	546, 549	–	–	1	1
Political Science	323	1	–	1	–
Practical Experience	696	–	–	–	–
Precambrian and Economic Geology Laboratory	397	–	–	–	2
Principles of Ore Dressing	181	2	–	–	–
Structural Geology	390, 391	2	3	–	3
Survey Camp	720	–	–	–	–

FOURTH YEAR SUBJECTS COURSE 9	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Engineering Economics	313	–	–	1	–
Geology of Canada	403, 404	2	–	1	2
Geology, Mining	393, 394	2	3	1	3
Geology, Pleistocene and Physiographic	381, 382	1	1	1	–
Geology, Precambrian	392	2	–	–	–
Geophysics	670, 671	2	6	2	6
Mine Management	172	2	–	–	–
Mineralography Laboratory	597	–	2	–	2
Mining	166, 171	–	–	2	3
Modern Political and Economic Trends	325	1	–	1	–
Optical Mineralogy Laboratory	596	–	2	–	2
Practical Experience	696	–	–	–	–
Profession of Engineering	327	–	–	½	–
Philosophy of Science	326	1	–	½	–
Silicate Chemistry	257	2	–	–	–
Thesis	738	–	4	–	6

AERONAUTICAL ENGINEERING

(COURSE 10)

Admission to and promotion in this course is granted only to students who meet the special requirements set forth on pages 24 and 156 of this Calendar.

The course is designed to provide a sound training in mathematics and science in the First and Second Years, together with certain fundamental subjects pertaining to the practice of aeronautical engineering. In the Third and Fourth Years, training is provided in those subjects now generally recognized as belonging strictly to the design, construction, and operation of aircraft.

The training in this course is planned to fit graduates to enter the technical design staffs of aircraft manufacturing companies. In Canada, Great Britain and the United States, due to the necessary emphasis on mass production for war purposes, there is a shortage of personnel training to enter design staffs. In these countries there will be opportunities for graduates in Aeronautical Engineering.

Students desiring to enter the Third Year of this course must have had at least two hours of instructional flying.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Algebra and Calculus, 502, page 137.

GRADUATE STUDY

Graduates of this University, or of other Universities of comparable standing, who have taken the above mentioned or similar course with sufficiently high records may proceed with work leading to a graduate degree.

The time devoted to graduate study is divided between work on the subjects of mathematics, aerodynamics, and related subjects to the approved field of investigation chosen by the candidate.

Further information appears on page 219. The Calendar of the School of Graduate Studies should be consulted for details.

FIRST YEAR SUBJECTS COURSE 10	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Algebra and Calculus	502	$3\frac{1}{2}$	–	$3\frac{1}{2}$	–
Analytical Geometry	503	$1\frac{1}{2}$	–	$1\frac{1}{2}$	–
Applied Mechanics	24	2	–	2	–
Chemistry	221, 222	2	3	2	3
Descriptive Geometry	270	1	–	1	–
Electricity	330	2	–	2	–
Engineering and Society	322	1	–	1	–
Engineering Problems and Drawing	279	–	3	–	6
English	610	1	–	1	–
Physical Training	640	–	2	–	2
Properties of Matter; Mechanics and Heat	650, 651	4	3	4	3
Surveying	710, 712	1	3	–	–

SECOND YEAR SUBJECTS COURSE 10	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Aeronautics	11	–	–	½	–
Analytical Geometry of Space	506	1	–	1	–
Applied Physics	75, 76	1	3	1	3
Descriptive Geometry	272	1	–	1	–
Differential Calculus	504	3	–	3	–
Dynamics	25	1	–	1	–
Economics	311	2	–	2	–
Engineering Problems and Drawing	286	–	6	–	6
Heat	658, 659	1	3	–	–
Heat Engines, Elementary	420	1	–	1	–
Integral Calculus and Differential Equations	505	3	–	3	–
Mechanics of Materials	23, 31	2	–	2	3
Physical Training	640	–	2	–	2
Theory of Machines A	465	2	–	2	–

Third Year Subjects Course 10	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Advanced Engineering Mechanics	27	1	–	1	–
Aeronautics	1	1	–	1	–
Aircraft Layout	12	–	–	–	3
Airplane Stress Analysis	9, 10	1	3	1	3
Alternating Currents	340	2	–	–	–
Applied Elasticity	33	1	–	1	–
Differential Equations	509	1	1	1	1
Direct Current Machines	338	–	–	2	–
Elementary Structural Engineering	29	1	–	1	–
Heat Engines, Theory	421, 423	2	3	2	3
Hydrodynamics	662	1	–	1	–
Machine Design	467, 468	2	6	2	6
Modern World History	324	1	–	1	–
Political Science	323	1	–	1	–
Theory of Functions	508	1	1	1	1

Fourth Year Subjects Course 10	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Aircraft Electricity	366	–	–	1	–
Aircraft Hydraulics	452	1	–	–	–
Aircraft Materials	551	1	–	1	–
Airplane Design and Layout	5, 6	2	9	2	9
Airplane Stress Analysis	7, 8	2	3	2	3
Applied Aerodynamics	3, 4	2	6	2	6
Differential Equations of Mathematical Physics	521	2	–	2	–
Elastic Analysis	32	1	–	1	–
Gas Dynamics	26	2	–	2	–
Internal Combustion and Aircraft Engines	425	1	–	1	–
Modern Political and Economic Trends	325	1	–	1	–
Philosophy of Science	326	1	–	$\frac{1}{2}$	–
Profession of Engineering	327	–	–	$\frac{1}{2}$	–
Thesis	739	–	–	–	–

ENGINEERING AND BUSINESS

(COURSE 11)

A substantial proportion of those who are admitted to the Faculty of Applied Science and Engineering have no particular interest in any one branch of technology, but desire a broad general training, preponderately engineering in character, that will fit them rather for executive or administrative positions, than for those of a purely technical or design nature. Many engineers nowadays occupy positions of responsibility in sales, production, purchasing, and other similar branches of industry, and for those who wish to enter such fields, the training offered should contain a greater proportion of economic, business, and management instruction than is possible in the distinctively technical courses.

The course in Engineering and Business is designed to cover that field and to be suitable for those who require such training. It is not expected that graduates from this course will immediately enter upon executive work; indeed, their early work may be almost entirely of a technical character, but it is anticipated that their ultimate tendency will be toward positions in the field of management or business. Their progress in that direction will depend largely on their own industry and abilities. Moreover, all engineers, whatever their duties may be, must be able to handle men as well as machines and their duties tend to become more and more administrative in character as they assume positions of increasing responsibility.

The subjects of instruction are shown in the following tables. In these tables, reference numbers have been assigned to the subjects referring to a more detailed description of each, e.g., Calculus 491, page 136.

Before receiving the degree, every student in Engineering and Business is required to submit satisfactory evidence that he has had practical experience satisfactory to the Committee administering the course.

The Association of Professional Engineers of the Province of Ontario requires three years satisfactory experience following graduation before granting registration as Professional Engineers to graduates of the course in Engineering and Business.

First Year Subjects Course 11	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry	492,277	1	1	2	1
Calculus	490,277	2	2	2	2
Chemistry	221,222	2	6	2	–
Descriptive Geometry	270	1	–	1	–
Dynamics	21,277	1	1	2	1
Electricity	330	2	–	2	–
Engineering and Society	322	1	–	1	–
Engineering Problems and Drawing	277	–	3	–	10
English	610	1	–	1	–
Mechanical and Thermal Measurements	448	–	–	2	–
Physical Training	640	–	2	–	2
Practical Experience	698	–	–	–	–
Statics	20	1	1	2	1
Surveying	710,712	1	3	–	–

Second Year Subjects Course 11	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Applied Physics	70, 71	1	3	1	3
Calculus	491	2	–	2	–
Descriptive Geometry	272	1	–	1	–
Direct Current Machines	338	–	–	2	3
Dynamics	22	1	–	1	–
Economics	311	2	–	2	–
Electricity	332, 334	2	3	–	–
Engineering Chemistry	226	1	–	1	–
Engineering Problems and Drawing	286	–	8	–	12
Heat Engines, Elementary	420	1	–	1	–
Hydraulics, Elementary	447	1	–	–	–
Industrial Chemistry	230	1	–	1	–
Mechanics of Materials	23, 31	2	3	2	–
Physical Metallurgy	533	–	–	2	–
Physical Training	640	–	2	–	2
Practical Experience	698	–	–	–	–
Public Speaking	320	–	–	–	1

THIRD YEAR SUBJECTS COURSE 11	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Accounting	306	2	1	2	1
Alternating Currents	340, 346	2	3	–	–
Applied Economics	308	2	–	2	2
Elementary Structural Engineering	29	1	–	1	–
Engineering Problems and Drawing	302	–	6	–	3
Heat Engines, Theory	421, 423	2	–	2	3
Hydraulics	440, 441	2	–	2	3
Industrial Management A	321	1	2	2	1
Machine Design	467, 468	2	3	2	3
Modern World History	324	1	–	1	–
Political Science	323	1	–	1	–
Practical Experience	698	–	–	–	–
Statistics	307	2	–	2	–

FOURTH YEAR SUBJECTS COURSE 11	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Alternating Current Machinery	345, 346	–	–	2	3
Business Policy	309	3	2	3	2
Engineering Economics	313	–	–	1	–
Engineering Law	314	1	–	–	–
Heat Treatment of Iron and Steel	547, 548	1	–	1	1½
Industrial Management B	328	2	3	2	3
Industrial Psychology	329	2	–	2	–
Light and Acoustics	91, 92	1	1½	1	1½
Manufacturing Processes	476, 477	2	3	2	3
Modern Political and Economic Trends	325	1	–	1	–
Philosophy of Science	326	1	–	½	–
Practical Experience	698	–	–	–	–
Profession of Engineering	327	–	–	½	–
Structural Engineering	46, 299	2	3	–	–
Thesis	740	–	1	–	1

OUTLINE OF LECTURE AND LABORATORY SUBJECTS

On the pages that follow a brief description is given of the lectures and laboratory subjects prescribed in the preceding tables of curriculum. The numbers before the subjects are the reference numbers assigned in the tables. For example, 20. Statics, means the course of lectures indicated by this number in the table of curriculum for the First Year on page 37.

AERONAUTICAL ENGINEERING

1. Aeronautics. T. R. Loudon.

Course 10, III Year; 1 hr. lecture per week, both terms.

An introductory course on the basic principles of aerodynamics and theory of flight. The elements of stability and control are discussed and the fundamental theory of performance estimation is outlined in these lectures.

Text books: Technical Aerodynamics—K. D. Wood. Aerodynamics of the Airplane—Millikan. Theory of Flight—Von Mises.

3. Applied Aerodynamics. B. Etkin.

Course 10, IV Year; 2 hrs. lectures per week, both terms.

An advanced course in aerodynamic theory, in which the following topics are discussed: performance estimation and calculation, airfoil theory, propellors, wind tunnel corrections, drag, stability and control, spinning, rotary wing aircraft, compressibility effects.

Text books: Applied Aerodynamics—Bairstow. Airfoil and Airscrew Theory—Glauert. Aerodynamics of the Airplane—Millikan. Aerodynamics Theory—Durand.

4. Applied Aerodynamics Laboratory. B. Etkin.

Course 10, IV Year; 6 hrs. laboratory per week, both terms.

This subject is intended to amplify the lecture course on hydrodynamics and aerodynamics. The calibration and practical use of wind tunnel instruments are explained, and experiments are carried out to illustrate the points discussed in the lectures.

5. Airplane Design and Layout. T. R. Loudon, B. S. Shenstone, J. W. Jakimiuk, W. H. Jackson, W. Czerwinski.

Course 10, IV Year; 2 hrs. lectures per week, both terms.

Methods of application of aerodynamic theory and stress analysis to the design of airplanes are discussed. Problems are set for the laboratory periods in which actual airplane layouts are made and stressed for the required conditions in practice.

Text books: Air Ministry Publications 970 and 1208. C.A.M.-04. C.A.M.-05.

6. Airplane Design and Layout Laboratory. T. R. Loudon, B. S. Shenstone, W. J. Jakimiuk, W. H. Jackson, W. Czerwinski.

Course 10, IV Year; 9 hrs. laboratory per week, both terms.

In this subject, the principles from the various lecture subjects on aerodynamics, stress analysis and layout are applied to the design of an aeroplane as a whole, and to its component parts. The British Air Ministry and U.S.A. conditions used in Canada are applied to these design problems.

7. Airplane Stress Analysis. T. R. Loudon.

Course 10, IV Year; 2 hrs. lectures per week, both terms.

An advanced course continuing the work of the Third Year on aircraft framed structures and stringer skin combinations. Shear flow in open and closed sections is discussed. Strain energy, the elastic centre and moment distribution methods are outlined. Simple and continuous beam columns are analyzed and various other structural problems encountered in aircraft design are taken up and problems worked out.

Text books: Airplane Structures—Niles and Newell. Airplane Structural Analysis and Design—Sechler and Dunn. Analysis and Design of Airplane Structures—Bruhn.

8. Airplane Stress Analysis. T. R- Loudon.

Course 10, IV Year; 3 hrs. laboratory work per week, both terms.

Problems are worked out using the theory explained in the lectures of subject 7. These problems all relate to aircraft.

9. Airplane Stress Analysis. T. R. Loudon.

Course 10, III Year; 1 hr. lecture per week, both terms.

Elementary principles of advanced structural analysis used in aircraft design. Problems are set to be worked out in the laboratory.

Text books: Airplane Structures—Niles and Newell. Airplane Structural Analysis and Design—Sechler and Dunn. Analysis and Design of Airplane Structures—Bruhn.

10. Airplane Stress Analysis Laboratory. T. R. Loudon, B. Etkin.

Course 10, III Year; 3 hrs. laboratory per week, both terms.

Problems based upon the lectures in subject 9 are worked out during these periods.

11. Aeronautics. T. R. Loudon.

Course 10, II Year; 6 lectures, second term.

An introductory course to the work of III Year Aeronautics (1).

12. Aircraft Layout. W. J. Jakimiuk, W. Jackson.

Course 10, III Year; 3 hrs. laboratory per week, second term.

Methods of layout and detailing peculiar to the aircraft industry.

APPLIED MECHANICS AND DESIGN OF STRUCTURES

20. Statics. T. R. Loudon.

Courses 1, 2, 3, 4, 6, 7, 8, 8a, 9, and 11, I Year; 1 hr. lecture per week, first term; 2 hrs. lectures per week, second term.

Fundamental principles of the laws of equilibrium of forces are discussed. These principles are applied to the determination of stresses in simple structures. Toward the end of the subject an introduction to Mechanics of Materials is given.

Text book: Engineering Mechanics-Statics—Timoshenko and Young.

21. Dynamics. M. W. Huggins, B. Etkin.

Courses 1, 2, 3, 6, 7, 8, 8a, 9, and 11, I Year; 1 hr. lecture per week, first term; 2 hrs. lectures per week, second term.

A subject designed to extend the elementary principles of preparatory school mechanics to a more general viewpoint. Under the heading of kinematics, the general equations of motion, both linear and angular, are developed.

Centres of mass and moments of inertia are calculated.

The principles of linear and angular momentum are dealt with and a fairly comprehensive course on effective and inertia forces as applied to engineering problems is given. The discussion of energy, work, and power is extended as far as possible to practical problems.

Simple harmonic motion is also discussed.

Text book: Principles of Physics, Mechanics—Sears.

22. Dynamics. I. W. Smith.

Courses 1, 3, 5, 7, and 11, II Year; 1 hr. lecture per week, both terms.

Motion of a point is reviewed and extended to include Coriolis' acceleration, with applications. Equations for motion of mass in translation, rotation, and plane motion are developed, including centre of percussion. Moment of inertia of mass is studied by double integration and by the lamina method. The derivation and application of gyroscopic action is thoroughly discussed, and an introduction to static and dynamic balancing is given.

Text book: Analytical Mechanics for Engineers—Seeley and Ensign.

23. Mechanics of Materials. T. R. Loudon, R. F. Legget, M. W. Huggins.

All courses, II Year; 2 hrs. lectures per week, both terms.

In this subject, the fundamental theories of stress and strain are discussed and applied in the design of tension members, riveted joints, pipes and tanks, beams, columns, shafts, etc. A number of problems are worked out both in the lecture course and in the drafting room.

Text books: Resistance of Materials—Seely.

24. Applied Mechanics. B. Etkin.

Courses 5 and 10, I Year; 2 hrs. lectures per week, both terms.

This subject is divided into two parts: one dealing with the application of the principles of statics to elementary framed structures and simple beams, and the other dealing with the fundamental principles of dynamics of a particle extended eventually to consideration of rigid bodies.

Text books: Engineering Mechanics (Vol. 1)—Timoshenko and Young. Principles of Physics, Mechanics—Sears.

25. Dynamics. B. Etkin.

Course 10, II Year; 1 hr. lecture per week, both terms.

Introduction to vectors; general plane motion of particles systems of particles, and rigid bodies; compound pendulum, centre of percussion, gyroscopes.

Text books: Engineering Mechanics (vol. 2)—Timoshenko and Young. Principles of Mechanics—Synge and Griffiths.

26. Gas Dynamics. G. N. Patterson.

Course 10, IV Year; 2 hrs. lectures per week, both terms.

An advanced course in the aerodynamic theory of compressible fluids. The main topics are: one dimensional gas dynamics, shock waves, method of small perturbations, characteristics, hodograph method, application to subsonic and supersonic aerofoils, transonic problems, experimental methods.

27. Advanced Engineering Mechanics. B. Etkin.

Course 10, III Year; 1 hr. lecture per week, both terms.

Introduction to the operators curl, div. and grad. Plane and Space dynamics using the vector rotation. Euler's equation for a rigid body. Lagranges equations. Vibrations. Dimensional analysis and model testing.

Text books: Principles of Mechanics—Synge and Griffiths. Engineering Mechanics (vol. 2)—Timoshenko and Young.

28. Elementary Structural Engineering. C. F. Morrison.

Course 1, III Year; 2 hrs. lectures per week, both terms.

An elementary study of the stress analysis and design of structures, structural members, and their details. Problems in analysis and design are worked out in the lectures and in the drafting room.

The work in the first term includes a discussion of tension members, steel and timber columns, simple and continuous beams, box girders, and plate girders. Welding as a method of connecting structural steel members is studied.

The second term is given chiefly to moving loads, the design of a riveted truss highway span, and the theory of railway truss spans.

Text books: Theory of Simple Structures—Shedd and Vawter. Structural Problems—Young. Steel Construction Handbook—A.I.S.C.

29. Elementary Structural Engineering. M. W. Huggins, W. H. M. Laughlin.

Courses 2, 3, 5r, 8a, 10, and 11, III Year; 1 hr. lecture per week, both terms.

Practically the same work as that for subject 28 in the first term.

30. Structural Design, C. F. Morrison.

Course 4, III Year; 2 hrs. lectures and 3 hrs. problems per week, both terms.

The stress analysis and design of elementary structures and structural members of timber, steel and reinforced concrete are studied in this subject. Practical problems on the design of beams, columns, piers, footings, and roof trusses are worked out in the drafting room. Some time is spent testing and determining the physical properties of structural materials.

Reference books: Architectural Construction—Gay and Parker. Design of Steel Buildings—Hauf. Elementary Structural Engineering—Urquhart and O'Rourke.

31. Mechanics of Materials: General. T. R. Loudon, W. L. Sagar, C. E. Helwig.

Courses 1, 2, 5, 9 and 10, II Year; 3 hrs. laboratory per week, second term.

Courses 3, 7, and 11, II Year; 3 hrs. laboratory per week, first term.

An introduction to the experimental study of the strength and elasticity of engineering materials. In it he should acquire a first hand knowledge of the properties of certain common materials of construction, and some familiarity with the manner in which they might be expected to behave when subjected to loads.

Reference book: Junior Laboratory Course in Mechanics of Materials, Department of Civil Engineering; Municipal and Structural.

32. Elastic Analysis. A. Grzedzielski.

Course 10, IV Year; 1 hr. lecture per week, both terms.

The general analysis of stress and strain is discussed and applied to aircraft problems.

33. Applied Elasticity. M. W. Huggins.

Courses 1 and 10, III Year; 1 hr. lecture per week, both terms.

A study of the stresses and strains in structural materials and members. The topics treated include: members subjected to direct stress, shear stress, and flexural stress, and their resulting deformations; principal stresses; statically indeterminate structures such as continuous and fixed-end beams; the moment-area theorems; photo-elasticity as a method of determining stress intensity.

Reference books: Elements of Strength of Materials—Timoshenko and MacCullough. Applied Elasticity—Timoshenko and Lessels.

34. Applied Elasticity. M. W. Huggins.

Course 1a, IV Year; 1 hr. lecture per week, both terms; 3 hrs. problems per week, first term; 2 hrs. problems per week, second term.

A study of deformations and stresses in the following: beams on elastic foundations; concrete water tanks; heads of steel tanks; streets, both uniform and tapered subject to axial and side loads; curved beams. Problems based on the work covered in the lectures are worked out in the computing period by analytical, photoelastic, and Begg's deformeter method.

Reference books: Strength of Materials, Vols. I and II—Timoshenko.

35. Cements and Concrete. W. L. Sagar, C. E. Helwig.

Course 1, III Year; 1 hr. lecture per week, both terms.

The work in the first term includes a discussion of the cements used in construction, Portland cement in particular, and a study of the basic principles of concrete making.

In the second term the elements of the theory of reinforced concrete are discussed and examples are considered in the design of slabs, beams, and columns.

Text books: Plain Concrete—Bauer. Chemistry of Cement and Concrete—Lea and Desch. Reinforced Concrete Design—Sutherland and Clifford. Reinforced Concrete Construction, Vol. I—Hool. Elementary Structural Engineering—Urquhart and O'Rourke.

36. Theory of Structures. C. F. Morrison.

Course 1, IV Year; 1 hr. lecture per week, both terms.

The stress analysis of simple span, continuous, and cantilever trusses. Influence lines and index stresses. Truss deflections by analytical and graphical methods. Arches, suspension bridges, and statically indeterminate structures.

Text books: Theory of Simple Structures—Shedd and Vawter. Theory of Modern Steel Structures, Vol. II—Grinter.

37. Advanced Structural Analysis. M. W. Huggins, C. F. Morrison.

Course 1a, IV Year; 1 hr. lecture, 2 hrs. problems per week, both terms.

The analysis of statically indeterminate structural problems, with particular reference to the following: flexural deflections by single and double integration, by moment areas, shear areas, elastic weights, dummy loads, and Castigliano's first theorem; the slope-deflection method; the moment-distribution method; the method of least work and the column analogy.

Reference book: Theory of Modern Steel Structures, Vol. II—Grinter.

38. Mechanics of Materials: General. T. R. Loudon, W. L. Sagar, C. E. Helwig.

Course 1, IV Year; 3 hrs. laboratory per week, both terms.

Practice in investigating the elastic and physical properties of iron, steel, concrete, timber, etc., and the use of instruments of precision designed for this purpose.

Reference book: Materials of Construction—Johnson.

39. Foundations and Retaining Walls. R. F. Legget.

Courses 1 and 4, IV Year; 1 hr. lecture per week, both terms.

A study of the necessity for accurate knowledge of sub-surface conditions as a preliminary to all foundation, retaining wall and dam design serves to introduce this course which deals with methods of sub-surface exploration, and the elements of the design of foundation units, bridge piers, and retaining walls of concrete and of steel. Attention is paid to relevant constructional requirements.

40. Soil Mechanics. W. L. Sagar, R. F. Legget.

Course 1, IV Year; 1 hr. lecture per week, first term.

A subject devoted to those physical and mechanical properties of soils of importance to the engineer, such as compressive and cohesive strengths, internal friction, stability in slopes, compressibility and other deformational characteristics, permeability and moisture retention. The bearing of these properties on the design and construction of engineering works is considered in detail.

Reference books: Engineering Properties of Soil—Hogentogler. Notes on Soil Mechanics and Foundations—Plummer.

41. Reinforced Concrete. C. F. Morrison.

Course 1, IV Year; 1 hr. lecture per week, both terms.

The theory of the strength of reinforced concrete elements, including the beam, the slab, the T-beam, the column, and the girderless floor, is continued in this subject.

The analysis of the monolithic arch by the elastic theory is discussed, and the student is required in the drafting room to apply his knowledge to the design of simple structures.

Reference books: Design of Concrete Structures—Urquhart and O'Rourke. Reinforced Concrete Design—Sutherland and Reese.

42. Structural Design. C. F. Morrison.

Course 4, IV Year; 1 hr. lecture and 3 hrs. problems per week, both terms.

The study of the analysis and design of structural members and structures is continued in this subject. The lectures are supplemented by problems assigned in the drafting room. These problems include the preparation of drawings showing the structural framing and details for various buildings.

43. Structural Design. C. F. Morrison, W. H. M. Laughlin.

Course 1, IV Year; 2 hrs. lectures per week, first term; 1 hr. lecture per week, second term.*

Consideration is given to the various types of industrial buildings and other structures, the conditions governing their choice, and the design and details of construction in different materials. Examples in design are worked out in the class and drafting rooms illustrating such points as: economic arrangement of building frames, probable loadings for girders and columns, column eccentricities, wind loading, wind bracing, rigid frames, crane runways, cableways, headframes, tanks and towers.

Reference books: Handbook of Building Construction—Hool and Johnson. Architects' and Builders' Handbook—Kidder-Parker. Steel Mill Buildings—Ketchum.

44. Mechanics of Materials: Concrete. T. R. Loudon, W. L. Sagar, C. E. Helwig.

Course 1, III Year; 2 hrs. laboratory per week, first term.

Fundamentals in the design of sound concrete, including acceptability tests on the materials used in making concrete, experiments to show the effect on the consistency and strength of the concrete caused by variations in the quantities of the ingredients, and the design of an economical mix for a given set of conditions.

Reference books: Design and Control of Concrete Mixtures—Portland Cement Association. Materials Testing—Gilkey, Murphy, Bergman.

46. Structural Engineering. C. F. Morrison.

Courses 3 and 11, IV Year; 2 hrs. lectures per week, first term.

A study is made of various types of industrial buildings and other structures. Methods of analysis and examples in design are considered, involving the use of timber, structural steel, and reinforced concrete.

Reference books: Elementary Structural Engineering—Urquhart and O'Rourke. Steel Mill Buildings—Ketchum. Handbook of building Construction—Hool and Johnson.

47. Structural Design. C. F. Morrison.

Course 4, V Year; 1 hr. lecture and 3 hrs. problems per week, both terms.

In this subject some of the more advanced work in reinforced concrete is studied, including flat slab construction, panels reinforced in two directions, rigid frames and arches. In the drafting room the students apply the principles of structural design to problems in which actual buildings are designed and detailed.

50. Mechanics of Materials: Soils and Highway. W. L. Sagar, R. F. Legget, C. E. Helwig.

Course 1, IV Year; 3 hrs. laboratory per week, second term.

Experiments relating to the physical properties of rocks such as are used in road building, and bituminous materials as used in road and airport construction. Physical and mechanical characteristics of soils, related to highway and foundation work, are investigated in a series of experiments that provide an introduction to practical Soil Mechanics.

Reference books: Construction of Roads and Pavements—Agg. Specifications—Dept. of Highways, Ontario. Soil Mechanics—Krynine.

APPLIED PHYSICS

70. Applied Physics. V. L. Henderson.

Courses 7 and 11, II Year; 1 hr. lecture per week, both terms.

Correlating the physical principles of light, heat, sound, and vibration with problems in engineering, emphasizing the importance of the analytical approach.

Reference books: Fundamental Principles of Physics—Heil and Bennett. Introduction to Physical Optics—Robertson.

71. Applied Physics Laboratory. V. L. Henderson.

Courses 7 and 11, II Year; 3 hrs. laboratory per week, both terms.

Supplementing subject 70.

72. Optics. K. B. Jackson.

Course 6, III Year; 1 hr. lecture per week, both terms.

Light, geometrical and physical optics, and optical instruments pertaining to chemical engineering.

Text books: Optical Methods of Chemical Analysis—Gibb. Elements of Optics—Valasek.

73. Optics Laboratory. K. B. Jackson.

Course 6, III Year; 3 hrs. laboratory per week, second term.

Supplementing subject 72.

75. Applied Physics. E. L. Dodington.

Courses 1 and 10, II Year; 1 hr. lecture per week, both terms.

Correlating the physical principles of light, heat, sound and vibration with problems in engineering, emphasizing the importance of the analytical approach.

Reference book: Handbook of Engineering Fundamentals—Eshbach.

76. Applied Physics Laboratory. E. L. Dodington.

Courses 1 and 10, II Year; 3 hrs. laboratory per week, both terms.

Supplementing subject 75.

77. Photography. K. B. Jackson.
Course 4, II Year; 1 hr. lecture per week, first term.
The principles of photography, photographic equipment, materials, and processes, with special reference to architectural photography.
Reference books: Elementary Photography—Quarles. Fundamentals of Photography—Boucher.

78. Photography Laboratory. K. B. Jackson.
Course 4, II Year; 3 hr. laboratory per week, first term.
Supplementing subject 77.

79. Photometry. K. B. Jackson, E. L. Dodington.
Courses 5c, 5i, and 5s, III Year; 1 hr. lecture per week, second term.
Photometry, and the use of photography as a scientific implement.

80. Photometry. E. L. Dodington.
Courses 5c, 5s, and 5i, III Year; 3 hrs. laboratory per week, second term.
Supplementing subject 79.

81. Photographic Surveying. K. B. Jackson.
Course 1, III Year; 1 hr. lecture per week, first term.
An introduction to the methods and applications of terrestrial and aerial photographic surveying.

82. Photographic Surveying. K. B. Jackson.
Course 1b, IV Year; 2 hrs. lectures per week, first term.
Photogrammetric optics, surveying, cameras, photographic materials and processes. Terrestrial and aerial photography. Radial plotting methods, mosaics, stereoscopic methods. Mapping from oblique photographs. Applications.

83. Photographic Surveying Laboratory. K. B. Jackson, Course 1b, IV Year; 5 hrs. laboratory per week, first term.
Supplementing subject 82.

85. Light and Acoustics. V. L. Henderson.
Course 4, III Year; 1 hr. lecture per week, both terms.
Production and propagation of sound, the control of reverberation, sound transmission through partitions, and vibration insulation; and an elementary course in the production of light, and the measurement of light and electricity, in preparation for subject 87.
Reference book: Acoustics of Buildings—Watson.

86. Light and Acoustics Laboratory. V. L. Henderson.
Course 4, III Year; 2 hrs. laboratory per week, both terms.
Supplementing subject 85.

87. Illumination Design. E. L. Dodington.
Course 4, IV Year; 1 hr. lecture per week, both terms.
Control of light distribution, the computation of illumination and brightness, and the design of lighting installations for public and private buildings.

88. Illumination Design Laboratory. E. L. Dodington.
Course 4, IV Year; 1 hr. laboratory per week, both terms.
Supplementing subject 87. By co-operation with the staff of the School of Architecture, problems in lighting design and acoustics will form a part of certain problems in architectural design in subjects 123, 124, and 125.

89. Architectural Acoustics. V. L. Henderson.
Course 5i, IV Year; 1 hr. lecture per week, first term; 3 hrs lectures per week, second term.
Design of buildings for good acoustics, the calculation and measurement of the acoustical properties of buildings and materials, and the treatment of buildings to improve their acoustical properties and to control the nuisance of noise.

90. Architectural Acoustics Laboratory. V. L. Henderson.
Course 5i, IV Year; 3 hrs. laboratory per week, first term; 9 hrs. laboratory per week, second term.
Supplementing subject 89.

91. Light and Acoustics. V. L. Henderson.
Course 11, IV Year; 1 hr. lecture per week, both terms.
The production of light and the engineering principles underlying its utilization.
The generation and control of sound.

92. Light and Acoustics. V. L. Henderson.
Course 11, IV Year; 1½ hrs. laboratory per week, both terms.
A laboratory course supplementing course 91.

93. Illumination. V. L. Henderson.
Course 7, IV Year; 1 hr. lecture per week, both terms.
Illuminating Engineering dealing with the production and measurement of light and colour, and the theory and design of lighting equipment and installations.
Reference books: Scientific Basis of Illuminating Engineering—Moon. Illuminating Engineering—Boast.

94. Illumination Laboratory. V. L. Henderson.
Course 7, IV Year; 3 hrs. laboratory alternate weeks, both terms.
Supplementing subject 93.

95. Photometry and Illumination Design. K. B. Jackson, V. L. Henderson.

Course 5i, IV Year; 2 hrs. lectures per week, both terms.

Measurements of luminous intensity, luminous flux, illumination, brightness, reflection, transmission, absorption, diffusion, and colour by visual and physical methods; and on the design and application of illuminating engineering equipment.

96. Photometry and Illumination Design Laboratory. K. B. Jackson, V. L. Henderson.

Course 5i, IV Year; 6 hrs. laboratory per week, both terms.

Supplementing subject 95.

97. Acoustics. V. L. Henderson.

Courses 5c and 5s, IV Year ; 1 hr. lecture per week, first term.

Acoustics of electrical sound systems; including sound waves, hearing, the mechanical-electrical-acoustical analogy, microphones, loud speakers, etc.

Reference books: Elements of Acoustical Engineering—Olson. Applied Acoustics—Olson and Massa.

98. Acoustics. V. L. Henderson.

Course 7, IV Year; 1 hr. lecture per week, first term.

This subject deals with the properties of acoustical elements, particularly with their application in electrical sound systems.

Reference books: Elements of Acoustical Engineering—Olson. Applied Acoustics—Olson and Massa.

99. Vibration Engineering. V. L. Henderson.

Course 5r, IV Year; 1 hr. lecture per week, both terms.

Vibrating systems with one degree of freedom. Electrical analogues and impedance methods. Systems with more than one degree of freedom. Application to machines and structures. Instrumental methods.

100. Vibration Laboratory. V. L. Henderson,

Course 5r, IV Year; 3 hrs. laboratory per week, both terms.

A series of experiments designed to give familiarity with the nature of vibrating systems and the causes, measurement, and control of vibration in engineering problems.

ARCHITECTURE,

110. History of Architecture. Anthony Adamson.

Course 4, I Year; 1 hr. lecture per week, both terms: 1 historical research project.

Development of architecture and structural methods in Ancient Egypt, Classical Greece, the Roman Empire, the Byzantine Empire.

Reference books: Egyptian Architecture as Cultural Expression —Baldwin Smith. Handbook of Greek and Roman Architecture—D. S. Robertson. Architecture Through the Ages—Talbot Hamlin.

111. History of Architecture. Anthony Adamson.

Course 4, II Year; 1 hr. lecture per week, both terms: 1 historical research project.

Development of European architecture and structural methods from the time of Constantine the Great till the end of the Gothic period.

Reference books: Mediaeval Architecture—A. K. Porter. Gothic Architecture in England—Francis Bond. Architecture Through the Ages—Talbot Hamlin.

112. History of Architecture A. H. H. Madill.

Course 4, III Year; 1 hr. lecture per week, first term.

In this subject the architecture of the Renaissance in Italy and France is studied with special reference to planning and composition.

Reference books: Architecture of the Renaissance in Italy—Anderson and Stratton. The Architecture of the Renaissance in France, Vols. I and II—W. H. Ward. Architecture Through the Ages—Hamlin.

113. History of Architecture B. E. R. Arthur.

Course IV. III Year.

This course is divided into two parts.

a. 1 hr. lecture week, first term. An illustrated series of lectures dealing with Renaissance buildings in general but with emphasis on the development of the English house. For that purpose two lectures are given at the beginning of the course on the Mediaeval house. The social history of the period 1500-1900 is a prescribed reading course.

Reference books: A History of Renaissance Architecture in England—Reginald Blomfield. The Growth of the English House—J. A. Gotch. The History of the English House—N. Lloyd. The Gothic Revival—K. Clark. The Architecture of Humanism—G. Scott. British Architects and Craftsmen—S. Sitwell. English Social History—G. M. Trevelyan.

b. 1 hr. lecture per week, both terms. The modern development in Architecture is traced from its roots in the Industrial Revolution of the 19th century to the present time. Examples are studied from the U.S. and Europe. In the second term, as a part of this course, several lectures are given on the subject of industrial design.

Reference books: Space, Time and Architecture—S. Giedion. Modern Building—W. C. Behrendt. Pioneers of the Modern Movement—N. Peusner. The Architecture of H. H. Richardson and His Times—H. H. Hitchcock. Life of William Morris—J. W. Mackail. Design This Day—W. D. Teague. Art and Industry—Herbert Read.

115. Functional Requirements of Buildings. J. A. Murray and others.
Course 4, III Year; 1 hr. lecture per week, both terms.
In this subject the principles underlying the planning of such buildings as churches, theatres, office buildings, etc., are discussed in detail.

116. Garden Design. H. B. Dunington Grubb.
Course 4, III Year; Special lectures, first term.
In this subject the historical development of Garden Design is traced from earliest times; the study of sites; the influence of topography, orientation, planting, access, etc., on the problems of design; site planning; the location of buildings; the solution of an actual problem on a typical site.

117. Town Planning. Anthony Adamson, J. A. Murray.
Course 4, V Year; 1 hr. per week, both terms: 1 design problem.
Part One: A short history of Urbanism. Part Two: Planning theory and practical data. Part Three: Planning practice and legislation.
Reference books: Culture of Cities—Lewis Mumford; Planning Administration—Ladislas Segoe; Planning the Small American City—R. Van N. Black. City Planning Reports.

118. Elements of Architectural Form. E. R. Arthur.
Course 4, I Year; 1 hr. lecture per week, both terms.
Introductory lectures leading to composition and planning in later years. Form, scale and proportion are studied. Simple domestic plans are discussed, and elements of design are examined in relation to actual buildings. These elements include windows, doors, roofs, texture, materials, etc.
Reference books: Theory and Elements of Architecture, Vol. 1, Part I—Robert Atkinson and Hope Bagenal. Design—P. E. Nobbs. Design this Day—W. D. Teague.

119. History of Painting. G. S. Vickers.
Course 4, IV Year; 1 hr. lecture per week, second term.
An outline of the history and development of painting and of the minor pictorial arts from the earliest time until the present day.

120. History of Sculpture. G. S. Vickers.
Course 4, III Year; 1 hr. lecture per week, first term.
History of architectural sculpture, including the modern.

121. Architectural Drawing. H. H. Madill, W. E. Carswell, S. R. Kent, J. Banigan.
Course 4, I Year; 15 hrs. studio per week, both terms.
The course commences with instruction in drafting and lettering. It becomes the drafting room component of a number of subjects

in the curriculum, including mathematics, applied mechanics, forms and details of elementary construction, isometric and perspective drawing. A number of "day designs" are held during the year.

122. Architectural Design. E. R. Arthur, R. J. K. Barker, W. J. McBain, C. F. T. Rounthwaite, W. Shulman.

Course 4, II Year; 21 hrs. studio per week, first term; 26 hrs. studio per week, second term.

In this year the student begins the serious study of design. The course consists of a series of problems in residential, commercial and industrial buildings. Individual instruction is given in the drafting room, and final drawings are criticized at the conclusion of each problem. A number of "day's designs" is included to train the student in quick thinking, and to develop his ability in sketch presentation. A set of working drawings is made for a small building in frame or masonry construction.

123. Architectural Design. E. R. Arthur, G. Englesmith.

Course 4, III Year; 17½ hrs. studio per week, first term; 20½ studio per week, second term.

This subject is given by individual instruction in the studio and by criticism of solutions of problems set during the year. The greater part of the subject is devoted to problems in design and forms a continuation of the subject given in the preceding year.

Basic problems studied in this Year include commercial and industrial buildings. One problem is carried through to working drawings in steel construction.

124. Architectural Design. E. R. Arthur, J. B. Langley.

Course 4, IV Year; 24 hrs. studio per week, both terms.

A continuation of the work of the preceding years, given by individual instruction in the studio and criticisms of the solution of problems set during the year. Basic problems studied in this Year include interior design and furniture, alterations, complex residential or institutional buildings. One problem is carried through to working drawings in concrete construction. One day sketch designs are given every two weeks.

125. Architectural Design. E. R. Arthur, J. A. Murray.

Course 4, V Year; 30 hrs. studio per week, first term; 30½ hrs. studio per week, second term.

The work of this year is divided into two parts. The first term is taken up with a problem related to site planning and housing followed by one or two problems in design, one of which is a prize problem. The second term is spent on the design thesis, the subject for which is submitted to the staff for approval at the end of the

work of the fourth year. The programme is then prepared during the summer vacation and submitted to the staff at the beginning of the fall term. This involves the study of a major building from the sketch stage to working drawings, including a report on the building. Specifications to include one trade as a minimum are required. Work is interrupted in both terms by sketch problems of one and two day duration.

In addition to the above, a "Written Thesis" is required. This is done in the student's own time and involves original thought on some such subjects as "The Social Aspects of Town Planning" or "The Aesthetics of Modern Architecture". 5000 words are required. The subject of this thesis is submitted at the end of the Fourth Year.

128. Theory of Architectural Planning. J. A. Murray.

Course 4, II Year; 1 hr. lecture per week, both terms.

The general principles of planning of buildings from small to complex problems. In the second term actual plans of libraries, banks, houses, etc., are studied as an aid to problems in design and a preliminary to work in the following years.

The discussions include planning methods, technical factors influencing architectural design, basic principles of massing, composition, proportion and scale.

Reference books: Elements of Form and Design in Classic Architecture—Arthur Stratton. The Modern House—F. R. S. Yorke. The Smaller English House of the Later Renaissance, 1660-1830—A. E. Richardson and H. D. Eberlein. The Plan Requirements of Modern Buildings—V. O. Rees.

130. Housing. E. R. Arthur.

Course 4, IV Year; 1 hr. lecture per week, first term.

This series deals with housing for sale or rent, but is concerned mainly with the lower income groups. The study includes financing, planning, land acquisition and housing legislation in Canada, the United States and England. The lectures are illustrated.

Reference books: Europe Rehoused—Elizabeth Denby. Modern Housing—Catherine Bauer. Report No. 4 of the committee on Housing and Community Planning. The Seven Myths of Housing —Nathan Straus.

131. Freehand Drawing and Water Colour Painting. W. E. Carswell.

Course 4, I Year; 2 hours studio per week, both terms.

Drawing from still life, freehand perspective, primary rendering in pencil and water colour.

132. Freehand Drawing, Water Colour Painting, and Rendering. W. E. Carswell, J. A. Hall.

Course 4, II Year; 2 hrs. studio per week, both terms.

Drawing and painting from still life, drawing in pencil, pen and ink, and wash. Primary water colour, drawing from landscape and pictorial composition.

In addition to the periods set out above, instruction is given in the studios in rendering (wash, charcoal, and other mediums), as problems in design approach completion.

Students are required to attend a course in field sketching at the University Survey Camp during the last week in September or in the vicinity of Toronto the second week in October.

133. Freehand Drawing, Water Colour Painting, and Rendering. W. E. Carswell, J. A. Hall.

Course 4, III Year; 2 hrs. studio per week, both terms.

Drawing and painting in wet and dry media from still life objects, landscape and from life.

Students are required to attend a course in field sketching at the University Survey Camp during the last week in September.

Students will report at the Camp on the date shown on page 5.

134. Freehand Drawing, Water Colour Painting and Rendering. W. E. Carswell, J. A. Hall.

Course 4, IV Year; 2 hrs. studio per week, both terms.

Abstract design, colour composition, and drawing from life.

Students are required to attend a course in field sketching at the University Survey Camp during the last week in September.

Students will report at the Camp on the date shown on page 5.

136. Colour. W. E. Carswell.

Course 4, II Year; 1 hr. lecture per week, first term.

This subject is intended to assist the student in an appreciation of the value of colour and its application to architecture. Colour in period and modern rooms, the effect of sunlight and shade on colour, and differences in treatment in domestic, civic and institutional buildings are examined in class and on the boards. Theory of colour is discussed and the student is made familiar with such modern systems as those of Ostwald and Munsell.

137. Modelling. Frederick Coates.

Course 4, II Year; 2 hrs. studio per week, both terms.

Scale models of architectural forms.

138. Modelling. Frederick Coates.

Course 4, III Year; 2 hrs. studio per week, both terms.

Scale models of simple buildings.

140. Building Construction. H. H. Madill.

Course 4, I Year; 1 hr. lecture per week, second term.

Instruction is given in elementary construction using common building materials and in the detailing of doors, windows, roofs, fireplaces, stairs, etc.

Reference book: Architectural Graphic Standards—Ramsey and Sleeper.

141. Building Materials: Architectural Application. H. H. Madill.

Course 4, IV Year; 1 hr. lecture per week, second term.

Properties and the use of the various materials used in building are studied from the architectural rather than the structural viewpoint.

A small exhibition room has been set aside in which examples of the most modern materials and devices are displayed. This room is open to the student at all times.

Reference books: Materials and Methods of Architectural Construction—Gay and Parker. Building Construction—W. C. Huntington.

142. Sanitary Science. H. H. Madill.

Course 4, IV Year; 1 hr. lecture per week, both terms.

Modern plumbing, its design and installation, drainage, sewage disposal and water supply.

Reference books: Mechanical and Electrical Equipment for Buildings—Gay and Fawcett.

143. Professional Practice. H. H. Madill.

Course 4, V Year; 1 hr. lecture per week, both terms.

This subject is designed to give an understanding of the professional character of the practice of architecture. In it are discussed the ethical, business, and legal relations of the architect to clients, contractors, craftsmen, engineers, and the professional bodies. The customs of office practice are also discussed.

Reference books: Architectural Practice and Procedure—H. H. Turner. The Architects Law Manual—C. H. Blake. The Law of Architecture and Building—C. H. Blake. Handbook of Architectural Practice A.I.A. Contact Forms of R.A.I.C. Engineering Law—Laidlaw and Young. Architects' Specifications—Goldsmith.

144. Heating and Air Conditioning. F. G. Ewens.

Course 4, V Year; 1 hr. lecture per week, both terms.

Instruction in methods of heat transfer, principles of design of steam, hot water and warm air heating systems, the use of the psychrometric chart, and design of ventilation and air conditioning systems.

Textbook: Heating and Air Conditioning—Allen and Walker.

145. Architectural Economics. W. S. Wilson.

Course 4, V Year; 1 hr. lecture per week, both terms.

Instruction in the various methods of preparing estimates, together with practical work in taking off quantities. Comparative costs of various types of materials and construction.

Building finance, revenue, and expenditure are also discussed.

147. Measured Drawings. E. R. Arthur.

Course 4, III Year.

Each student is required to submit, not later than the day of registration, a set of measured drawings of an existing building, along with the record of measurements and sketches neatly arranged in a note book. The subjects must be approved before measuring is begun. The study is marked as a separate subject, on the same basis as term work.

148. Outdoor Sketches. W. E. Carswell.

Course 4, IV Year.

Each student is required to submit, on or before the opening day of the session, a set of at least seven outdoor sketches in water colour, pen and ink, or pencil. The minimum size for each sheet will be 9″ × 12″. Of these sketches at least four will be in pencil and at least three will be of an architectural character.

ASSAYING, MINING, AND ORE DRESSING

The work in Mining is designed to give a thorough training in the underlying principles of Mining in its various branches, including exploration, development, and production. Special attention is paid to the practical and business aspects of these subjects.

The teaching of assaying has a two-fold function. The first is to give the student a working knowledge of the practice of the art, so that he can earn money as an assayer, upon graduation, and use this as a stepping-stone to other positions. The second is to use the assaying laboratories for the training of students in certain important phases of engineering methods. The size of the apparatus, the completeness of the processes in short intervals of time, the extreme accuracy of results when so desired, the relation of the extent of error to time and method, the similarity of the academic laboratory to the field laboratory—all these permit an unrivalled opportunity for driving home much broad engineering philosophy. The assaying processes and apparatus lend themselves peculiarly well to the development of a proper perspective in regard to errors and accuracy in measurements.

160. Assaying.

Courses 2, 8, and 9, III Year; 1 hr. lecture per week, both terms.

Theory and practice of fire assaying. Emphasis is laid not only upon the principles of chemistry, metallurgy and sampling involved,

but also upon the errors inherent in operators as well as in methods.

References: Manual of Fire Assaying—Fulton and Sharwood. Textbook of Fire Assaying—Bugbee. Fire Assaying—Shepherd and Dietrich.

161. Assaying Laboratory.

Courses 2, 8, and 9, III Year; 3 hrs. laboratory per week, both terms.

Determination of precious metals. Some lecture instruction is given. Scorification and crucible assays of ores, pure and impure; and of milling and metallurgical products, including cyanide solutions. Buckboard practice on ores with metallics is given. Students are expected to do their later assays with despatch and a reasonable degree of accuracy.

164. Assaying Laboratory.

Course 8a, III Year; 3 hrs. laboratory per week, first six laboratory periods of first term; two lecture periods of 2 hrs. each for the first two Mondays of the session.

An introductory laboratory subject for ceramic engineers. Some lecture instruction is given. An abbreviation of subjects 160 and 161.

165. Mining Laboratory. C. G. Williams, S. E. Wolfe.

Courses 2 and 9, I Year; 2 hrs. laboratory per week, first term.

A laboratory subject including some lectures, being an introduction to certain mining and milling machinery and methods.

166. Mining Laboratory. C. G. Williams, S. E. Wolfe.

Courses 2 and 9, IV Year; 6 hrs. laboratory per week, second term.

Special mining problems.

167. Mining. C. G. Williams.

Courses 2 and 9, II Year; 1 hr. lecture per week, first term. An introductory course of lectures.

168. Mining. S. E. Wolfe.

Course 8, II Year; 1 hr. lecture per week, both terms.

Principles of Mining.

170. Mining. C. G. Williams.

Courses 2 and 9, III Year; 1 hr. lecture per week, both terms. Principles of mining.

171. Mining. C. G. Williams.

Courses 2 and 9, IV Year; 2 hrs. lectures per week, second term.

Special problems, estimates, reports.

172. Mine Management. C. G. Williams.
Courses 2 and 9, IV Year; 2 hrs. lectures per week, first term.
Consideration of organization, efficiency methods of operation, some of the business aspects of mining and pays particular attention to labour relations.

173. Mine Ventilation and Allied Problems. G. R. Lord.
Course 2, IV Year; 2 hrs. lectures per week, first term.
Ventilation problems in Canadian mines, including the use of ventilation equipment, selection of fans, testing equipment, ventilation studies, the silicosis problem, fire control, etc.

174. Mine Ventilation Laboratory. The Staffs in Mining and Mechanical Engineering.
Course 2, IV Year; 3 hrs. laboratory per week, first term.
Experiments in the laboratories and problems in the study room to give the student some practice in the use of ventilation test equipment, and the solution of ventilation problems.

175. Ore Dressing. C. G. Williams.
Courses 2 and 8, III Year; 2 hrs. lectures per week, second term.
The general principles of ore dressing.

176. Ore Dressing Laboratory. C. G. Williams, S. E. Wolfe.
Courses 2 and 8, III Year; 6 continuous hrs. laboratory per week, second term.
Work with crushing machinery, principles of crushing and grading, screen analyses, concentration with gravity separation apparatus, etc.

177. Ore Dressing. C. G. Williams.
Courses 2 and 8, IV Year; 1 hr. lecture per week, both terms.
Subject 175 continued, study of flow sheets, and special problems.

178. Ore Dressing. C. G. Williams, S. E. Wolfe.
Courses 2 and 8, IV Year; 6 continuous hrs. laboratory per week, first term.
Advanced work with ore dressing appliances, ore testing, and check mill runs.

180. Ore Dressing Laboratory. C. G. Williams, S. E. Wolfe.
Course 8a, IV Year; 3 hrs. laboratory per week, both terms.
Principles of sampling, crushing, and grading, screen analyses, concentration with gravity separation apparatus, flotation, ore testing, etc.

181. Principles of Ore Dressing. S. E. Wolfe.

Courses 2, 8 and 9, III Year; Course 8a, IV Year; 2 hrs. lectures per week, first term.

Ore dressing methods involve a study of the laws governing the phenomena of surface tension, capillarity, and colloidal solutions, in addition to those of hydrostatics and certain phases of hydraulics. This is embodied in a special course of lectures in conjunction with laboratory work in the ore dressing laboratory.

182. Theory of Measurements. S. E. Wolfe.

Courses 2 and 9, II Year; 1 hr. lecture per week, first term.

This title is not an entirely suitable one for this subject because it is generally applied to a study of the philosophy of extremely accurate measurements. The mining engineer has to continually make satisfactory use of measurements with a wide range of inaccuracy. This subject deals with the philosophy underlying the causes of these errors and the practical application of such approximations. The opportunity is taken in these lectures to deal with the subject of illustrating measurements by graphs.

183. Introductory Research. C. G. Williams, S. E. Wolfe.

Course 2, III Year; 3 hrs. laboratory per week, second term.

A laboratory subject consisting of short experimental problems. It is designed to develop the individual student's initiative by his systematic observance of the effects of variables.

184. Summer Letters. C. G. Williams.

Course 2, III Year.

A series of letters written during the summer vacation, dealing with various aspects of a mining engineer's work. These are intended to direct and help the student's powers of observation, analysis, and criticism, as well as being exercises in the art of lucid technical expression.

Special instructions will be issued in connection with these letters.

185. Summer Essays. C. G. Williams.

Course 2, IV Year.

Special instructions will be given in connection with this work.

186. Problems and Seminar. The Staff in Mining Engineering.

Course 2, II, III, and IV Years; Course 9, II Year; 2 hrs. seminar per week, first term.

A seminar in which the students discuss technical and business problems, under their own supervision. A portion of the time is given to guest speakers on special subjects.

ASTRONOMY AND GEODESY

200. Practical Astronomy. J. W. Melson.

Course 1, II Year; 2 hrs. lectures per week, second term.

Practical determination of time, latitude, and azimuth, by methods adapted to the use of the surveyor's transit. The subject

will be designed to enable the student to carry out these observations at the Summer Survey Camp.

Reference books: Nautical Almanac, 1947. Printed Lecture Notes—S. R. Crerar.

201. Astronomy and Geodesy. J. W. Melson.

Course 1, III Year; 2 hrs. lectures per week, second term.

Determination of time, latitude, longitude, and azimuth, by methods adapted to the use of the surveyor's transit and the sextant. It is designed to fulfil the requirements of the final examinations for Ontario and Dominion Land Surveyors.

In Geodesy an account is given of the principles and methods of a secondary triangulation survey, also of the principles involved in the North-west system of survey.

Text books: Practical Astronomy as applied to Geodesy and Navigation—Doolittle. Notes on Practical Astronomy and Geodesy. Nautical Almanac.

BOTANY

210. Properties of Living Matter. G. H. Duff.

Course 5r, III Year; 2 hrs. lectures per week, both terms.

Cellular and protoplasmic organization from both the structural and functional points of view.

211. Low Temperature Physiology. G. H. Duff.

Course 5r, IV Year; 1 hr. lecture per week, both terms.

Cryophilic organisms and the physiological and biochemical effects of low temperature.

212. Low Temperature Physiology Laboratory. G. H. Duff.

Course 5r, IV Year; 3 hrs. laboratory per week, both terms.

A laboratory subject supplementing subject 211.

CIVIL ENGINEERING

215. Municipal Engineering. A. E. Berry.

Course 1c, IV Year.

a. Municipal Engineering—Sanitary. 1 hr. lecture per week both terms; 5 hrs. laboratory per week, first term; 4 hrs. laboratory per week, second term.
b. Municipal Engineering—Administration. 1 hr. lecture per week, second term.

Problems of water supply, sewerage, and municipal sanitation as viewed by the engineer. This subject includes the design of water distribution and sewer systems, as well as water and sewage treatment works. Municipal government, assessment and taxation, municipal finance, public utilities, expropriation, annexation problems, town planning, local improvement, and other laws

relating to municipalities. Problems are assigned, from assumed data and from material secured in the field, to be worked out in the drafting room under subject 301.

216. Transportation Engineering. W. M. Treadgold, W. L. Sagar, R. F. Legget.

Course 1d, IV Year; 2 hrs. lectures per week, both terms; 5 hrs. laboratory per week, first term; 4 hrs. laboratory per week, second term.

Principles governing the location, design, and construction of railways, highways, airports, and inland waterways.

217. Water Power Engineering. R. F. Legget, G. R. Lord.

Course 1e, IV Year; 2 hrs. lectures per week, both terms; 5 hrs. laboratory per week, first term; 4 hrs. laboratory per week, second term (see subject 444).

Principal features of the hydraulic design of water power and water control projects, including hydrological studies, design of pipe lines, surge tanks, and canals; elements of water power machinery and water control equipment, together with the design of water-retaining structures such as earth and concrete dams.

CHEMISTRY AND CHEMICAL ENGINEERING

221. Chemistry. J. M. Morton, C. P. Brockett, W. M. Hutcheon, E. T. Williams, P. M. Reilly.

Courses 1, 2, 3, 5, 6, 7, 8, 8a, 9, 10, and 11, I Year; 2 hrs. lectures per week, both terms.

Advanced chemical theory, with industrial and engineering applications.

222. Chemical Laboratory. L. J. Rogers, E. A. Smith, R. R. McLaughlin, D. J. Le Roy.

Courses 1, 3, 7 and 11, I Year; 6 hrs. laboratory per week, one term.

Courses 2, 8 and 9, I Year; 6 hrs. laboratory per week, both terms.

Courses 6 and 8a, I Year; 9 hrs. laboratory per week, one term; 6 hrs. laboratory per week, other term.

Courses 5 and 10, I Year; 3 hrs. laboratory per week, both terms.

Quantitative experiments illustrating the use of the sensitive balance, and confirming the fundamental laws of chemistry; qualitative inorganic analysis; quantitative analysis.

223. Inorganic Chemistry. C. P. Brockett.

Courses 6, 8 and 8a, II Year; 1 hr. lecture per week, both terms.

A continuation of subject 221.

225. Analytical Chemistry. L. J. Rogers.

Courses 2, 8 and 9, III Year; 1 hr. lecture per week, both terms.

Principles of chemical analysis; select gravimetric and volumetric methods; technical analysis.

226. Engineering Chemistry. W. M. Hutcheon, E. T. Williams, P. M. Reilly.

Courses 1, 3, 7 and 11, II Year; 1 hr. lecture per week, both terms.

Water-softening, corrosion, petroleum, explosives, rubber, and plastics.

227. Analytical Chemistry Laboratory. E. A. Smith.

Courses 2 and 9, II Year; 3 hrs. laboratory per week, second term.

Gravimetric determination of metals and acids, with elementary volumetric analysis, accompanied by lectures.

228. Analytical Chemistry Laboratory. L. J. Rogers.

Courses 8 and 8a, II Year; 9 hrs. laboratory per week, both terms.

Comprising gravimetric and volumetric methods, acidimetry and alkalimetry.

Text books: Analytical Chemistry, Vol. II—Treadwell-Hall. Qualitative Chemical Analysis—A. A. Noyes.

229. Chemical Laboratory. L. J. Rogers, F. E. Beamish, R. R. McLaughlin, E. A. Smith.

Course 6, II Year.

This subject will commence September 2, and will continue until September 20, 1947, the entire working week being spent in the laboratory on quantitative analysis.

230. Industrial Chemistry. E. A. Smith.

Courses 6 and 8a, II Year; 1 hr. lecture per week, first term; 2 hrs. lectures per week, second term.

Course 11, II Year; 1 hr. lecture per week, both terms.

Manufacture of acids, alkalies, and inorganic chemicals; water-softening, corrosion, explosives.

232. Industrial Chemistry and Technical Analysis. E. A. Smith.

Course 6, II Year; 11 hrs. laboratory per week, first term.

An introductory laboratory subject in industrial chemistry containing experiments on petroleum products, fertilizers, etc., colorimetric determination of hydrogen-ion, stoichiometric calculations, instruction in glass-blowing.

234. Organic Chemistry. J. G. Breckenridge.

Course 6, II Year; 2 hrs. lectures per week, both terms.

An introductory course in organic chemistry, with emphasis on reaction conditions and yields, and the industrial significance of certain compounds and reactions.

235. Organic Chemical Laboratory. R. R. McLaughlin, J. G. Breckenridge.

Course 6, II Year; 10 hrs. laboratory per week, second term.

A laboratory subject accompanying lecture subject 234.

236. Physical Chemistry. D. J. Le Roy, E. H. Smith.

Courses 6, 8, and 8a, II Year; Course 9, III Year; 2 hrs. lectures per week, both terms.

Principles of Phase Rule; introduction to chemical thermodynamics and theory of solutions.

237. Analytical Chemistry Laboratory. L. J. Rogers.

Courses 2 and 9, III Year; 4 hrs. laboratory per week, first term; 3 hrs. per week, second term.

Technical analysis of ores and furnace products.

238. Industrial Chemistry and Chemical Engineering.

Industrial Chemistry. E. A. Smith.

Course 6, III Year; 13½ hrs. laboratory per week, second term.

A continuation of subject 232, containing experimental work on coal, petroleum, illuminating gas, sugars, starch, etc., potentiometric determination of hydrogen-ion, and stoichiometric calculations.

Chemical Engineering. Staff in Chemical Engineering.

Course 6, III Year; 30 hrs. laboratory.

Experiments in Chemical Engineering introductory to subject 251.

239. Metallurgical Theory.

Course 8, III Year; 2 hrs. lectures per week, both terms.

A course for metallurgy students dealing particularly with Chemical Thermodynamics as applied to metallurgical reactions.

240. Chemical Theory. R. R. McLaughlin, W. C. Macdonald.

Courses 6 and 8a, III Year; 2 hrs. lectures per week, second term

Chemical theory.

241. Industrial Chemistry. E. A. Smith.

Course 6, III Year; III Year Honour Chemistry (Arts); 1 hr. lecture per week, both terms.

Petroleum and its products, coal tar and its products, fats, oils, soap, sugar, starch, fermentation industries, etc.

242. Chemical Engineering. W. C. Macdonald, J. E. Myers.

Courses 6 and 8a, III Year; 2 hrs. lectures per week, first term.

The theory and practice of heat transfer, evaporation, filtration, and other industrial operations.

Text book: Elements of Chemical Engineering — Badger and McCabe.

244. Organic Chemistry. R. R. McLaughlin.

Course 6, III Year; 2 hrs. lectures per week, both terms.

A continuation of subject 234.

245. Organic Chemical Laboratory. R. R. McLaughlin, J. G. Breckenridge.
Course 6, III Year; 12 hrs. laboratory per week, first term.
A laboratory subject accompanying lecture subject 244.

246. Electrochemistry. F. E. W. Wetmore.
Courses 6 and 8, III Year; 16 lectures, first term.
Elementary electrochemistry.

247. Electrochemistry Laboratory. F. E. W. Wetmore.
Course 6, III Year; 18 hrs., first term.
Course 8, III Year; 3 hrs. per week, first term.
Quantitative measurements to accompany subject 246.

248. Chemical Engineering Thermodynamics. W. C. Macdonald.
Course 6, IV Year; 1 hr. lecture per week, both terms.
Chemical thermodynamics, dealing with problems in chemical engineering.

249. Organic Chemistry. R. R. McLaughlin, J. G. Breckenridge.
Course 6, IV Year; 1 hr. lecture per week, both terms.
A continuation of subjects 234 and 244.

250. Organic Chemistry. R. R. McLaughlin, J. M. Morton.
Courses 2, 5, 8a and 9, II Year; 1 hr. lecture per week, both terms.
General reactions and methods of synthesis of carbon compounds.
Text book: Chemistry of Organic Compounds—Conant.

251. Chemical Engineering and Organic Chemistry. Staff in Chemical Engineering.
Course 6, IV Year; 15 hrs. laboratory per week, first term.
This subject is a continuation of subjects 238 and 245, and includes experiments involving quantitative measurements on chemical engineering equipment, production of organic compounds using small-scale pilot-plant apparatus, and certain experiments in the fields of physical, analytical, and organic chemistry.

252. Chemical Engineering Problems. W. C. Macdonald.
Course 6, IV Year; 2 hrs. laboratory per week, second term.
Calculations in connection with various problems in chemical engineering.

253. Chemical Engineering. W. C. Macdonald.
Course 6, IV Year; 1 hr. lecture per week, both terms.
A continuation of subject 242.

254. Graphical Methods in Chemical Engineering. W. C. Macdonald, J. E. Myers.
Course 6, IV Year; 1 hr. laboratory per week, both terms.
This subject gives the student instruction and practice in the use of elementary principles for constructing nomograms, and the derivation of empirical equations by graphical methods.

255. Electrochemistry. J. T. Burt-Gerrans.

Course 8, IV Year; 1 hr. lecture per week, both terms.

Advanced theory of solutions and electrolysis, and the application to the practice of electro-deposition and electrolytic refining of metals. The subject also includes lectures on the electric furnace with special consideration of efficiency.

Reference books: Electrometallurgy — Borchers. Principles of Applied Electrochemistry—Allmand and Ellingham. The Electric Furnace — Stansfield. The Electric Furnace — Pring. Physical Chemistry for Colleges—Millard.

256. Electrochemistry Laboratory. J. T. Burt-Gerrans.

Course 8, IV Year; 3 hrs. laboratory per week, second term.

A laboratory subject accompanying subject 255.

Reference book: Practical Physical Chemistry—Findlay.

257. Silicate Chemistry. J. B. Ferguson.

Course 9, IV Year; 2 hrs. lectures per week, first term.

The application of phase rule to the chemistry of refractory materials.

258. Industrial Chemistry. E. A. Smith, T. L. Crossley.

Course 6, IV Year; 1 hr. lecture per week, first term.

IV Year Forestry; 1 hr. lecture per week, both terms.

Pulp and paper, and cellulose industries.

259. Chemical Theory. W. C. Macdonald.

Course 6, IV Year; 1 hr. lecture per week, first term; 2 hrs. lectures per week, second term.

A course on applied chemical kinetics and Phase Rule.

DESCRIPTIVE GEOMETRY, ENGINEERING PROBLEMS AND DRAWING

DESCRIPTIVE GEOMETRY

270. Descriptive Geometry. J. R. Cockburn, A. Wardell.

All Courses, I Year; 1 hr. lecture per week, both terms.

This subject deals chiefly with the principles of orthographic and oblique projections and the application of such principles to the solutions of problems relating to straight lines and planes.

272. Descriptive Geometry. J. R. Cockburn, J. J. Spence.

Courses 1, 2, 3, 4, 5, 7, 9, 10, and 11, II Year; 1 hr. lecture per week, both term.

A continuation of the work taken in the First Year, with the following additions: problems relating to curved surfaces, principles of shades, shadows and perspective.

274. Descriptive Geometry. J. R. Cockburn.

Course 1, III Year; 1 hr. lecture per week, first term.

Spherical projections, the principles of mapmaking, and the graphical solution of spherical triangles.

ENGINEERING PROBLEMS AND DRAWING

These subjects consist primarily in the solving of problems by the student at the drafting table under the personal guidance of an instructor. The problems are intended to supplement certain lecture courses. The problems in the First and Second Years deal with the fundamental engineering studies—Mathematics, Applied Mechanics, Descriptive Geometry, the plotting of surveys that have been made by the students in the field, Theory of Mechanism, and Steam Engines, while in the Third and Fourth Years, the problems deal mainly with design. During the hours devoted to mathematical problems, members of the staff in mathematics are present to assist.

275. Engineering Problems and Drawing. A. Wardell.

Course 1, I Year; 14 hrs. per week, first term; 9 hrs. per week, second term.

Drawing and lettering. Plotting of original surveys. Problems in descriptive geometry. Graphical and analytical solutions of problems in applied mechanics. Problems in mathematics (analytical geometry and calculus).

276. Engineering Problems and Drawing. A. Wardell.

Courses 2 and 9, I Year; 6 hrs. per week, first term; 6 hrs. per week, second term.

Similar to subject 275.

277. Engineering Problems and Drawing. A. Wardell.

Courses 3 and 11, I Year; 8 hrs. per week, first term; 15 hrs. per week, second term.

Similar to subject 275.

278. Engineering Problems and Drawing. A. Wardell.

Course 4, I Year; 3 hrs. per week, both terms.

Elementary drawing and lettering. The solving of a few problems in descriptive geometry, applied mechanics, and mathematics.

279. Engineering Problems and Drawing. A. Wardell.

Courses 5 and 10, I Year; 3 hrs. per week, first term; 6 hrs. per week, second term.

Drawing and lettering. Problems in descriptive geometry. Graphical and analytical solutions of problems in applied mechanics.

280. Engineering Problems and Drawing. A. Wardell.

Course 6, I Year; 4 hrs. per week, first term; 8 hrs. per week, second term.

Elementary drawing and lettering. The solving of a few problems in descriptive geometry, applied mechanics, and mathematics.

281. Engineering Problems and Drawing. A. Wardell.
Course 7, I Year; 11 hrs. per week, first term; 6 hrs. per week, second term.
Similar to subject 275.

282. Engineering Problems and Drawing. A. Wardell.
Course 8, I Year; 8 hrs. per week, first term; 7 hrs. per week, second term.
Similar to subject 275.

283. Engineering Problems and Drawing. A. Wardell.
Course 8a, I Year; 5 hrs. per week, first term; 7 hrs. per week, second term.
Similar to subject 280.

284. Engineering Problems and Drawing. J. J. Spence.
Course 1, II Year; 8 hrs. per week, both terms.
Problems in descriptive geometry—intersection of curved surfaces. Plotting of original surveys. Problems in mechanics of materials—properties of sections, designs of simple members. Problems in mathematics (calculus).

285. Engineering Problems and Drawing. J. J. Spence.
Courses 2 and 9, II Year; 8 hrs. per week, both terms.
Problems in descriptive geometry, mechanics of materials. Flow sheet.

286. Engineering Problems and Drawing. J. J. Spence.
Course 3, II Year; 8 hrs. per week, first term; 12 hrs. per week, second term.
Course 10, II Year; 6 hrs. per week, both terms.
Course 11, II Year; 6 hrs. per week, first term; 8 hrs. per week, second term.
Problems in descriptive geometry—intersection of curved surfaces. Problems in mechanics of materials, theory of mechanism, heat engines, electricity. Problems in mathematics (calculus).

287. Engineering Problems and Drawing. J. J. Spence.
Course 6, II Year; 3 hrs. per week, first term; 6 hrs. per week, second term.
Problems in mechanics of materials, electricity, and mathematics.

288. Engineering Problems and Drawing. J. J. Spence.
Course 7, II Year; 6 hrs. per week, first term; 3 hrs. per week, second term.
Similar to subject 286, but with more problems in mathematics.

289. Engineering Problems and Drawing. J. J. Spence.
Course 8, II Year; 3 hrs. per week, first term; 3 hrs. per week, second term.
Problems in mechanics of materials, electricity, and mathematics.

290. Engineering Problems and Drawing. J. J. Spence.
Course 8a, II Year; 3 hrs. per week, first term; 6 hrs. per week, second term.
Similar to subject 287.

291. Engineering Problems and Drawing. W. B. Dunbar.
Course 1, III Year; 10 hrs. per week, first term; 9 hrs. per week, second term.
Problems in design of steel structures, riveted and welded connections, tension members, beams, columns, highway and railway trusses. Problems in descriptive geometry to illustrate the theory of map making.

292. Engineering Problems and Drawing. W. B. Dunbar.
Course 2, III Year; 3 hrs. per week, first term.
Problems in design of steel structures, riveted and welded connections, tension members, beams, columns.

293. Structural Design Drawing. W. B. Dunbar.
Course 3, III Year; 3 hrs. per week, both terms.
Similar to subject 292.

296. Engineering Problems and Drawing. W. B. Dunbar.
Course 5r III Year; 3 hrs. per week, second term.

297. Engineering Problems and Drawing. W. B. Dunbar.
Course 8a, III Year; 3 hrs. per week, both terms.

298. Engineering Problems and Drawing, Structural. W. B. Dunbar, P. V. Jermyn.
Course 1, IV Year; 6 hrs. per week, first term; 8 hrs. per week, second term.
Advanced problems on the design of steel and reinforced concrete structures—floor panels, mill buildings, tanks, reservoirs, towers, truss and arch bridges, foundations, dams, retaining walls, wind bracing. Problems on moment distribution in rigid frames, influence lines, and deflection of trusses.

299. Structural Design Drawing. W. B. Dunbar, P. V. Jermyn.
Courses 3 and 11, IV Year; 3 hrs. per week, first term.
Problems on the determination of stresses in, and the design of mill, building, flume trestles, crane runways, and floor panels for machinery loading.

300. Plant Design.
Course 8a, IV Year; 3 hrs. per week, second term.
Original design of ceramic plants, driers, kilns, etc.

301. Engineering Problems and Drawing, Sanitary. A. E. Berry, M. W. Huggins.
Course 1c, IV Year; 3 hrs. per week, both terms.
Problems on the design of water distribution and sewer systems as well as water and sewage treatment works.

302. Structural Design Drawing. W. B. Dunbar.

Course 11, III Year; 6 hrs. per week, first term; 3 hrs. per week second term.

Similar to subject 292.

ECONOMICS, BUSINESS ADMINISTRATION, AND LAW

306. Accounting.

Course 11, III Year; 2 hrs. lectures and 1 hr. laboratory per week, both terms.

An introduction to the theory and practice of Accounting, the procedures followed in the preparation of financial statements, and the use of Accounting as a means of control.

307. Statistics

Course 11, III Year; 2 hrs. lectures per week, both terms.

An introduction to statistical technique to include frequency distributions, correlation, curve fitting, sampling theory and an introduction to statistical quality control.

308. Applied Economics.

Course 11, III Year; 2 hrs. lectures per week, both terms, 2 hrs. laboratory per week, second term.

The economics of the individual firm; the capital market, the labour market, and typical commodity markets; problems of industrial fluctuation.

309. Business Policy.

Course 11, IV Year; 3 hrs. lectures and 2 hrs. laboratory per week, both terms.

A discussion of the organization of business enterprises, particularly in the field of manufacturing industry; problems of internal administration; relations with other firms and with governments; use of accounting and statistical data in connection with business problems.

310. Business. R. R. Grant.

Courses 1, 2, 3, 6, 7, 8, 8a and 9, III Year; 1 hr. lecture per week, second term.

Elements of business and the basic organization thereof with an introduction to the principles of control through accounting records. The preparation of simple financial statements and explanations of the purpose of the information shown therein. A brief description of the use of business papers such as invoices, bills of exchange, and others.

311. Economics. V. W. Bladen.

All courses, II Year; 2 hrs. lectures per week, both terms.

An introduction to the study of Economics with special reference to the problems of the Canadian economy.

Text book: An Introduction to Political Economy—Bladen.

312. Commercial Law. D. Vanek.

Course 4, III Year; 1 hr. lecture per week, both terms.

General Principles of the Law of Contracts, Principal and Agent, Partnership and Limited Companies, with special reference to the Companies Acts. General view of the following:—Negotiable Instruments, Sale of Goods, Bills of Sale and Chattel Mortgages, Suretyship and Guarantee.

Text book: Manual of Canadian Business Law—Falconbridge and Smith.

313. Engineering Economics. C. R. Young.

Courses 1, 2, 3, 7, 8, 9, and 11, IV Year; 1 hr. lecture per week; second term.

Principles by which the economic practicability of a project is judged and the comparison of competing proposals is made. Consideration is given to first cost and annual cost, methods of estimating, fixed charges and operating expenses, financing of engineering projects, valuation and appraisals. Special attention is given to depreciation and the methods of providing for it. Typical numerical problems are discussed and solved.

Text books: Engineering Economics—Fish. Financial Engineering—Goldman. Principles of Engineering Economy—Grant.

314. Engineering Law. P. H. Mills.

Courses 1, 3, 6, 7 and 11, IV Year; 1 hr. lecture per week, first term.

Course 1c, IV Year; 1 hr. lecture per week, first term.

A subject designed to co-ordinate engineering practice and law. In the work that is common to all students taking the subject, attention is directed to the duties and liabilities of the engineer, workmen's compensation, patents and inventions, copyrights, trade marks, industrial designs, promotion of companies, organization of companies, arbitration, expert evidence, trade unions, combines, industrial disputes and professional engineering associations.

Students in the Municipal Engineering Option are given additional lectures dealing with railways, highways, boundaries and surveys, easements and drainage.

Text book: Engineering Law—Laidlaw and Young.

315. Contracts and Specifications. R. F. Legget.

Courses 1 and 4, IV Year; 1 hr. lecture per week, second term.

Fundamental principles of contract and specification writing. The critical examination of typical specifications and agreements by the class, forms an essential feature of the instruction.

Text book: Engineering Law—Laidlaw and Young.

316. Introduction to Management. R. F. Legget.

Course 1, IV Year; 1 hr. lecture per week, both terms.

Lectures dealing with the fundamental principles upon which management is based. Examples are so selected as to provide an introduction to construction practice. The second half is devoted principally to personnel problems and practices in industry and construction. A selected list of required reading is provided.

317. Plant Management. C. G. Williams.

Course 8, IV Year; 1 hr. lecture per week, second term.

Twelve lectures dealing with some phases of labour, plant organization.

318. Industrial Management. E. A. Allcut.

Courses 3, 6, 7 and 8a, IV Year; 1 hr. lecture per week, both terms.

A study of industrial organization, location, arrangement, construction, and equipment of industrial plants for efficiency and economy, process routing, scheduling work, reports, methods of superintending, employment, systems of compensating labour, and systems of distributing indirect expenses.

Text book: Principles of Industrial Management—Allcut.

320. Public Speaking. G. A. McMullen, W. C. Macdonald, A. M. Fitzgerald.

Course 11, II Year; 1 hr. lecture per week, second term.

Course 4, III Year; 1 hr. lecture per week, both terms.

Course 6, IV Year; 1 hr. lecture per week, both terms.

Principles of public speaking and the means of expression, accompanied by practical application and training in actual speaking.

321. Industrial Management A.

Course 11, III Year; 1 hr. lecture and 2 hrs. laboratory per week, first term; 2 hrs. lectures and 1 hr. lararatory per week, second term.

An introduction to industrial organization and management, dealing particularly with its more technical aspects. Such problems as plant location, layout, arrangement, construction, handling of materials, inspection, design, and report writing are dealt with.

Text book: Principles of Industrial Management—Allcut.

322. Engineering and Society. C. R. Young, H. A. Innis, H. L. Shepherd, J. H. Dales.

All courses, I Year; 1 hr. lecture per week, both terms.

A series of lectures on economic history intended to show the dynamic role of science and technology in the development of the modern world, and the slow adaptation of social institutions under

the impact of rapid technological change. Some attention will be given to the evolution of the more important branches of engineering and the origin of important existing practices and procedures.

323. Introduction to Political Science. R. MacG. Dawson.

All courses, III Year; 1 hr. lecture per week, both terms.

An introduction to the study of government with special reference to the problems of Canadian government.

324. Modern World History. E. W. McInnis.

All Courses, III Year; 1 hr. lecture per week, both terms.

An outline of the chief trends and developments since the beginning of the 19th Century, with emphasis on Britain, the United States, and the main aspects of international relations.

325. Modern Political and Economic Trends. L. T. Morgan, J. E. Hodgetts.

All courses, IV Year; 1 hr. lecture per week, both terms.

A study of recent economic and political trends with particular reference to developments in the United States under the New Deal, in Italy since 1922, and in Russia since 1919.

326. Philosophy of Science. T. A. Goudge.

Courses 1, 2, 3, 5, 6, 7, 8, 8a, 9, 10, and 11, IV Year; Course 4, V Year; 18 lectures, first term, and part of second term.

Origin and development of scientific method; the range of the sciences; logical principles and the analysis of fundamental concepts; problems of life, mind and society.

327. The Profession of Engineering. C. R. Young, R. F. Legget.

Courses 1, 2, 3, 5, 6, 7, 8, 8a, 9, 10, and 11, IV Year; 6 lectures, second term.

Professional engineering organizations in Canada; engineering societies and services; professional ethics; social implications of engineering; the engineer and conservation.

328. Industrial Management B.

Course 11, IV Year; 2 hr. lecture and 3 hrs. laboratory per week, both terms.

A continuation of subject 321, dealing with such matters as production, planning, time and motion study, costs, budgetary control, and payment of labour. Particular emphasis is placed upon the study of Industrial Relations.

329. Industrial Psychology. W. Line.

Course 11, IV Year; 2 hrs. lectures per week, both terms.

The Worker as a person. His nature and needs; achievement and satisfaction; ability, motivation, interest; adjustment and de-

velopment. Individual differences. Learning at the level of skills and knowledge, and in a social sense. Morale, loyalty and responsibility.

Administrative provisions. The principles applied to administrative problems, e.g. conditions of work, diagnosis of difficulties, constructive policies; supply of personnel, selection, training and supervision.

Special Services. The role of professional services, e.g. health, social welfare, psychological service etc.: their relation to the executive and to the community.

ELECTRICITY

330. Electricity. D. N. Cass-Beggs, H. O. Coish, V. V. Mason, H. F. Philp, A. G. Ratz, G. F. Vail, E. Wall.

Courses 1, 2, 3, 5, 6, 7, 8, 8a, 9, 10 and 11, I Year; 2 hrs. lectures per week, both terms.

Principles relating to electric circuits, magnetic circuits, instruments, and apparatus in general, with illustrations from commercial practice. The point of view is quantitative rather than descriptive.

Reference books: Introduction to Electrical Engineering—Mueller. Electrical Engineering—Christie.

331. Alternating Currents. E. Wall.

Courses 1, 2, 8 and 9, II Year; 1 hr. lecture per week, both terms.

Fundamental calculations of alternating current circuits and various applications of interest to those who are not making electricity a major subject.

332. Electricity. J. E. Reid, H. O. Coish, H. A. Courtice, H. F. Philp, A. G. Ratz, G. F. Vail.

Courses 3, 5, 6, 8, 8a, and 11, II Year; 2 hrs. lectures per week, first term.

Course 7, II Year; 2 hrs. lectures per week, second term.

General principles and calculation of electrical circuits, particularly as applied to the measurement of resistance, current, potential difference, inductance, capacity, power, and energy. The principles underlying commercial instruments are considered, together with the methods of calibration.

Reference books: Electrical Measurements—Laws. Electrical Measurements in Theory and Application—Smith. Electrical Measurements and Measuring Instruments—Golding.

333. Electrical Fundamentals. J. E. Reid, V. V. Mason.

Course 7, II Year; 2 hrs. lectures per week, both terms.

A series of lectures extending the study of the fundamental principles underlying the work of subject 332. Applications considered are of particular interest to electrical engineers.

334. Electrical Measurements Laboratory. J. E. Reid.

Courses 3, 5, 6, 8, 8a, and 11, II Year; 3 hrs. laboratory per week, first term.

Course 7, II Year; 6 hrs. laboratory per week, second term.

The more important methods of measurement of resistance, current, potential difference, inductance, and capacity are used, often under conditions such as occur in practice. The principles of measurement are applied to other problems such as the location of line faults and the measurement of temperature rise by resistance changes. Methods of calibrating commercial instruments are also included.

336. Mathematical Applications in Electrical Engineering. L. S. Lauchland.

Course 7, III Year; 3 hrs. lectures per week, second term.

These lectures are intended to co-ordinate certain branches of mathematics, such as complex numbers, simple determinants, and elementary differential equations, with their applications to the problems of electrical engineering.

337. Electronics. J. E. Reid.

Courses 5c, 5i, 5s, and 7, III Year; Course 5r, IV Year; 3 hrs. lectures per week, second term.

The behaviour of electrons in electric and magnetic fields and the applications of electronics to electrical engineering.

338. Direct Current Machines. A. R. Zimmer, H. F. Philp, A. G. Ratz, G. F. Vail.

Courses 3 and 11, II Year; Course 10, III Year; 2 hrs. lectures per week, second term.

Courses 3 and 11, II Year; 3 hrs. laboratory per week, second term.

A course on the theory and operation of direct current generators and motors.

Reference books: Electrical Engineering, IVol. —Dawes. Electrical Circuits and Machinery, Vol. I—Morecroft and Hehre. Elements of Electrical Engineering—Cook.

339. Direct Current Machines. D. N. Cass-Beggs.

Courses 5 and 7, III Year; 2 hrs. lectures per week, first term.

The theory and operation of direct current machines. Methods of calculating the operating characteristics of generators and motors are presented and illustrated by the use of problems.

Reference books: Electrical Engineering, Vol. I—Dawes. Electrical Circuits and Machinery, Vol. I—Morecroft and Hehre. Principles of D.C. Machines—Langsdorf. Direct Current Machinery—Pender. Electrical Engineering—Christie. Elements of Electrical Engineering—Cook. D.C. Machinery—Kloeffler, Brenneman and Kerchner. Direct Current Machinery—McFarland. Direct Current Machinery—Bull.

340. Alternating Currents. A. R. Zimmer.

Courses 3, 5r, 10, and 11, III Year; 2 hrs. lectures per week, first term.

Courses 6 and 8a, III Year; 2 hrs. lectures per week, first term.

Measurements in simple single-phase and polyphase circuits. Circuit problems are solved by analytical and graphical methods. The operation of induction and synchronous motors and transformers is discussed briefly.

Reference books: Electrical Engineering, Vol. II—Dawes. Electrical Circuits and Machinery, Vol. II—Morecroft and Hehre. Elements of Electrical Engineering—Cook.

341. Alternating Currents. A. R. Zimmer, L. S. Lauchland.

Courses 5c, 5g, 5i, 5s, and 7, III Year; 2 hrs. lectures per week, both terms.

A first course of lectures on alternating current, covering principles of measurement and leading to the analytical and graphical treatment of the simpler problems relative to alternating-current circuits and machinery.

Reference books: Electricity and Magnetism for Engineers, Part II—Pender. Electrical Engineering—Christie. Electrical Engineering, Vol. II—Dawes. Electrical Circuits and Machinery, Vol. II—Morecroft and Hehre. Alternating Current Circuits—Kerchner and Corcoran. Alternating Current Circuits—Bryant, Correll and Johnson. Alternating Current Electrical Engineering—Maccall. Alternating Current Electrical Engineering—Kemp. Elements of Electrical Engineering—Cook.

342. Electrical Design. L. S. Lauchland.

Courses 5c, 5i, 5s and 7, III Year; 2 hrs. lectures per week, first term.

Course 7, III Year; 6 hrs. laboratory per week, first term.

Derivation and application of formulae used in the design of magnets, direct current machines, transformers, and other electrical equipment.

343. Electrical Problems and Seminar.

Course 7, III Year; 3 hrs. per week, both terms.

344. Electrical Laboratory. A. R. Zimmer, R. G. Anthes.

Courses 5c, 5g, 5i and 5s, III Year; 6 hrs. laboratory per week, both terms.

Course 7, III Year, 6 hrs. laboratory per week, first term; 3 hrs. laboratory per week, second term.

A group of experiments on direct current machines, another group on the fundamentals of alternating current circuits, together with experiments on properties of magnetic materials, and on the fundamentals of electronic devices. Introductory experience in the use of alternating current machinery is afforded.

345. Alternating Current Machinery. D. E. McGregor.
Courses 3, III Year; Course 11, IV Year; 2 hrs. lectures per week, second term.
Characteristics of alternating current machines and the various methods of control.

346. Electrical Laboratory. A. R. Zimmer.
Course 3, III Year; 3 hrs. laboratory per week, both terms.
Course 11, III Year; 3 hrs. laboratory per week, first term.
Course 11, IV Year; 3 hrs. laboratory per week, second term.
Experiments on alternating current circuits and machines.

347. Electrical Laboratory. A. R. Zimmer.
Course 5r, III Year; 3 hrs. laboratory per week, both terms.
A modified subject based on subject 344.

348. Electrical Machinery. D. E. McGregor.
Courses 2 and 8, III Year; 2 hrs. lectures per week, first term.
Lectures and demonstrations dealing with the operation and characteristics of electrical machinery.

349. Electrical Laboratory. A. R. Zimmer.
Courses 6 and 8a, III Year; 3 hrs. laboratory per week, first term.
Experiments on direct current generators and motors, and alternating current circuits and machines.

350. Electrical Laboratory. A. R. Zimmer.
Courses 1, 2, 8 and 9, II Year; 3 hrs. laboratory per week, second term.
Experiments planned to give a general knowledge of the operation of direct current machines, simple alternating current circuits, and alternating current machines.

351. Alternating Current Circuit Analysis. V. G. Smith.
Courses 5c and 7, IV Year; 2 hrs. lectures per week, both terms.
Applications of advanced analytical methods made to a.c. bridges, electrical filters, and other networks. Several general network theorems are obtained. The method of symmetrical components is developed and used to solve problems involving unbalance in three-phase circuits. Complex wave forms of voltage and current and their analysis are considered in detail. Simple transients in a.c. circuits are also studied.
Reference books: Principles of Alternating Currents—Lawrence. Alternating Current Circuits—Weinbach. Alternating Current Bridge Methods—Hague. Symmetrical Components—Wagner and Evans. Alternating Current Circuits—Kerchner and Corcoran.

352. Electrical Transmission of Energy. J. E. Reid.

Courses 5c and 7, IV Year; 2 hrs. lectures per week, first term.

The essential factors involved in the electrical transmission of energy. The distributed inductance and capacity of a three-phase transmission line are found. The behaviour of a long line when the voltages and currents are sinusoidal is examined in detail. Graphical constructions are developed and applied to both short and long lines.

Reference books: Transmission Line Theory—Franklin and Terman. Principles of Transmission in Telephony—Weinbach.

353. Alternating Current Machinery. D. N. Cass-Beggs.

Courses 5r and 7, IV Year; 2 hrs. lectures per week, both terms.

A course of lectures on the theory and performance of alternating current power transformers; synchronous generators, motors, and converters; single and polyphase asynchronous motors.

Reference books: Theory of Alternating Current Machinery—Langsdorf. Principles of Alternating Current Machinery—Lawrence. Alternating Current Machines—Puchstein and Lloyd. Alternating Current Machinery—Bryant and Johnson. Electrical Engineering—Christie.

354. Alternating Current Measurements. J. E. Reid.

Course 7, IV Year; 2 hrs. lectures per week, first term.

A.c. bridges for the measurement of inductance, capacitance, resistance, power factor, frequency, etc. The theory, use, and calibration of instrument transformers are covered. The measurement of power, reactive power, and associated quantities in polyphase circuits is discussed.

355. Electrical Laboratory. A. R. Zimmer, D. N. Cass-Beggs.

Course 7, IV Year; 6 hrs. laboratory per week, both terms.

Studies of principles and properties of single-phase and polyphase circuits and apparatus. Vector and analytical methods are applied to the solution of problems related to the characteristics of transformers, alternators, synchronous motors, converters, induction motors, transmission lines, and other alternating current equipment. The principles and properties of electronic equipment used in low frequency and power fields, such as mercury arc rectifiers and thyratrons, are studied.

Reference books: Electrical Engineering—Christie. Experimental Electrical Engineering, Vols. I and II—Karapetoff. Principles of A.C. Machinery—Lawrence. A.C. Machinery—Bryant and Johnson. Principles of Alternating Current Machinery—Langsdorf

356. Electrical Laboratory. A. R. Zimmer, D. N. Cass-Beggs.

Course 5c, IV Year; 6 hrs. laboratory per week, both terms.

A modified course based on subject 355.

357. Engineering Electronics. D. N. Cass-Beggs.

Course 7, IV Year; 1 hr. lecture per week, first term; 2 hrs. lectures per week, second term.

Electronic devices, such as the thyratron, ignitron and mercury arc rectifier, and their application to engineering problems.

Reference books: Electron Tubes in Industry—Henney. Fundamental Electronics and Vacuum Tubes—Albert. Fundamentals of Engineering Electronics—Dow. Applied Electronics—E. E. Staff, M.I.T.

358. Electrical Design. L. S. Lauchland.

Course 7, IV Year; 1 hr. lecture and 3 hrs. laboratory per week, second term.

A continuation of subject 342.

359. Seminar.

Course 7, IV Year; 3 hrs. per week, both terms.

361. Communication. B. deF. Bayly.

Courses 5c and 7, IV Year; 2 hrs. lectures per week, both terms.

Courses 5i and 5s, IV Year; 2 hrs. lectures per week, first term.

This subject has been arranged so that the work of the first term includes tubes and circuits for amplification, detection, modulation, etc., while the work of the second term covers fundamental communication networks such as filters, bridges and impedance-matching networks.

Reference books: Communication Engineering—Everitt. Fundamentals of Vacuum tubes—Eastman. Fundamentals of Engineering Electronics—Dow. Communication Networks, Vols. I and II—Guillemin. High Frequency Measurements—Hund.

362. Communication Laboratory. B. deF. Bayly, R. G. Anthes.

Courses 5c and 7, IV Year; 3 hrs. laboratory per week, both terms.

Courses 5i, and 5s, IV Year; 3 hrs. laboratory per week, first term.

Principles of measurement and demonstrations of principles described in lecture subject 361.

364. Operational Methods. V. G. Smith.

Courses 5c, 5i and 5s, IV Year; 2 hrs. lectures per week, both terms.

A few examples of earlier operational methods are given. The operators of electric circuits are developed and solutions obtained, in the course of which several useful rules concerning shifting and transfer operations, and differentiation and integration with respect to parameters are found and applied. The Heaviside expansion theorem is developed in a simple manner. The connection between

Heaviside's methods and the classical methods of Fourier Integrals and Contour Integration is investigated in some detail. Application is made throughout to engineering problems, chiefly in the field of electric circuit analysis.

Reference books: Electromagnetic Theory—Heaviside. Operational Circuit Analysis—Bush. Electric Circuit Theory and the Operational Calculus—Carson. Heaviside's Operational Calculus—Berg. Fourier Integrals for Practical Applications—Campbell and Foster.

365. Applied Electromagnetic Theory. V. G. Smith.

Courses 5c, 5g and 5s, IV Year; 2 hrs. lectures per week, both terms.

The laws of electromagnetism are reviewed and Maxwell's field equations developed. Plane electromagnetic waves and their reflection and refraction at plane surfaces are studied. Skin effects in cylindrical conductors, both solid and hollow are considered. Transmission of energy by wave guides and co-axial cables is investigated. The laws and formulae of the radiation of energy from vertical antennae are developed. The capacity of cables and transmission lines is computed and comparison made between the exact and approximate formulae. Magnetic fields due to conductors carrying current in the neighbourhood of ferromagnetic bodies are investigated in some of the more simple cases.

Reference books: Electromagnetic Theory—Heaviside. Electromagnetic Theory—Stratton. Electromagnetic Problems in Electrical Engineering—Hague.

366. Aircraft Electricity. J. E. Reid.

Course 10, IV Year; 1 hr. lecture per week, second term.

Types of electrical equipment used in aircraft and airports, and with the principles of aircraft radio equipment such as the radio range, radio compass, radio altimeter, direction finding, etc.

367. A. C. Machinery Laboratory. D. N. Cass-Beggs.

Course 5r, IV Year; 3 hrs. laboratory per week, first term.

A short laboratory course in alternating current electrical machinery.

368. Electronics Laboratory. D. N. Cass-Beggs, J. E. Reid, R. G. Anthes.

Course 5r, IV Year; 3 hrs. laboratory per week, second term.

A short laboratory course in electronics, vacuum tubes, and engineering electronics.

GEOLOGICAL SCIENCES

GEOLOGY

380. Geological Field Work. G. B. Langford, W. W. Moorhouse.
Courses 2 and 9, III Year; one week at the University Survey Camp preceding the opening of the first term.

381. Geology, Pleistocene and Physiographic. A. MacLean.
Courses 2 and 9, IV Year; 1 hr. lecture per week, both terms.
Pleistocene Geology. The formation and distribution of the drift deposits of North America, with brief references to other regions.
Physiography. The surface forms of the earth, and the geological factors that have produced them.
Reference books: Ice Ages, Recent and Ancient, and The Last Million Years—Coleman. Physiography—Salisbury.

382. Geological Excursions. A. MacLean.
Courses 2 and 9, IV Year.
During October weekly trips will be made to points of interest near Toronto.

383. Historical Geology. L. S. Russell.
Course 9, III Year; 2 hrs. lectures per week, both terms.
Principles of sedimentation, divisions of the geological column, and the use of fossils in correlation of formations.
Textbook: Historical Geology—Schuchert and Dunbar.

384. Historical Geology Laboratory. L. S. Russell.
Course 9, III Year; 2 hrs. laboratory per week, both terms.
Study of fossils, sediments, and geological maps and sections. A laboratory course to accompany subject 383.

385. Engineering Geology. A. MacLean.
Courses 1 and 5g, III Year; 1 hr. lecture per week, first term; 2 hrs. lectures per week, second term.
Structural, dynamic and economic geology, with special reference to engineering problems.
Reference books: Engineering Geology—Ries and Watson Geology and Engineering—Legget.

386. Engineering Geology Laboratory. G. B. Langford.
Courses 1 and 5g, III Year; 2 hrs. laboratory per week, second term.
Specimens, maps, and sections to accompany subject 385.

388. General Geology. F. G. Smith.
Courses 2 and 9, II Year; 2 hrs. lectures per week, first term; 1 hr. lecture per week, second term.

Geological principles, designed to introduce the student to the study of geology.

Reference books: Geology—Emmons, Thiel, Stauffer, and Allison. Elementary Geology for Canada—Moore.

389. General Geology. F. G. Smith.

Courses 2 and 9, II Year; 2 hrs. laboratory per week, second term.

Maps and sections; accompanying subject 388.

390. Structural Geology. G. B. Langford.

Courses 2 and 9, III Year; Course 5g, IV Year; 2 hrs. lectures per week, first term.

Structures caused by the deformation of the earth's crust.

Text books: Geologic Structures—Willis. Structural Geology—Nevin.

391. Structural Geology. G. B. Langford.

Courses 2 and 9, III Year; Course 5g, IV Year: 3 hrs. laboratory per week, both terms.

Work with geological maps of folded and faulted areas, structure sections, and the solution of problems relating to folding and faulting. Laboratory course to accompany subject 390.

392. Precambrian Geology. E. S. Moore.

Courses 2 and 9, IV Year; 2 hrs. lectures per week, first term.

Precambrian formations of Canada—their rocks, distribution, relationships, and economic features. Briefer accounts are given of similar formations in the United States and elsewhere.

Reference books: Publications of the Dominion and Provincial geological surveys. Mineral Deposits of the Canadian Shield—Bruce.

393. Mining Geology. G. B. Langford.

Course 9, IV Year; 2 hrs. lectures per week, first term; 1 hr. lecture per week, second term.

Detailed study of the geology of Canadian and foreign mining camps.

394. Mining Geology. G. B. Langford.

Course 9, IV Year; 3 hrs. laboratory per week, both terms.

A laboratory course to accompany subject 393.

396. Mining Geology. E. S. Moore.

Course 2, IV Year; 2 hrs. lectures per week, second term.

Geological problems associated with mining, typical mining regions in Canada, the United States, and elsewhere discussed from the geological side.

Reference books: Gold Fields of the World—Emmons. Economic Mineral Deposits—Bateman.

397. Precambrian and Economic Geology Laboratory. W. W. Moorhouse.
Course 9, III Year; 2 hrs. laboratory per week, second term.
Special attention to Precambrian formations and the microscopic features of the rocks and mineral deposits.

398. Economic Geology. E. S. Moore.
Course 9, III Year; Course 5g, IV Year.
(*a*) Ore Deposits: 1 hr. lecture per week, both terms.
Discussion of the origin and classification of ore deposits, the mode of occurrence of the chief ores, and statistics of production. Special attention is given to the metals mined in Canada.
(*b*) Economic Geology of the non-metals: 2 hrs. lectures per week, second term.
The origin and mode of occurrence of the valuable non-metallic substances—coal, oil, building stone, gypsum, cement materials, etc.
Reference books: Economic Geology — Ries. Coal — Moore. Geology of Petroleum and Natural Gas—Lilley. Mineral Resources of Canada—Moore. Introduction to the Study of Ore Deposits—Hatch.

399. Economic Geology. E. S. Moore, F. G. Smith.
Course 2, III Year.
(*a*) Ore Deposits: 1 hr. lecture per week, both terms.
(*b*) Economic Geology of the non-metals: 1 hr. lecture per week, second term.
Similar to subject 398.

400. Economic Geology Laboratory. G. B. Langford.
Course 9, III Year; Course 5g, IV Year; 3 hrs. laboratory per week, both terms.
Ores, geological features of mining areas, interpretation of drill logs, geological maps, and structure sections. Excursions are included.

401. Location of Mineral Deposits. G. B. Langford.
Course 5g, IV Year; 1 hr. lecture per week, second term.
Geological features and principles involved in the application of geophysical methods in the search for mineral deposits, and the interpretation of the structure of the earth's crust.

402. Economic Geology. G. B. Langford.
Course 8a, IV Year; 2 hrs. lectures per week, second term.
The nature, occurrence, and origin of non-metallic deposits, excepting fuels.
Reference book: Industrial Minerals and Rocks—A.I.M.E.

403. Geology of Canada. A. MacLean.
Course 9, IV Year; 2 hrs. lectures per week, first term; 1 hr. lecture per week, second term.
A survey of the physiography, historical geology, major structural features, and mineral deposits of the country.

404. Geology of Canada. A. MacLean.
Course 9, IV Year; 2 hrs. laboratory per week, second term.
Accompanying subject 403.

405. Building Materials; Stones. G. B. Langford.
Course 4, IV Year; 1 hr. per week, first term.
Lectures and laboratory work on decorative and structural stones used in building; their properties, sources, extraction, and preparation for use in buildings.
Reference book: Building Stones and Clay Products—Ries.

HEAT ENGINES

420. Elementary Heat Engines. The Staff in Mechanical Engineering.
Courses 3, 10 and 11, II Year; 1 hr. lecture per week, both terms.
Courses 2, 7, 8 and 9, II Year; 1 hr. lecture per week, first term.
The history and development of heat engines generally, the principles upon which they operate, and brief descriptions of the mechanical and thermal features of the different kinds of heat engines used in practice.
Text book: An Introduction to Heat Engines—Allcut.

421. Theory of Heat Engines. The Staff in Mechanical Engineering.
Courses 3, 5r, 6, 7, 8a, 10, and 11, III Year; 2 hrs. lectures per week, both terms.
The application of the laws of thermodynamics, indicating the best conditions for heat engine operation and the maximum possible efficiency, as exemplified by the Carnot and regenerative cycles. The properties of working fluids are studied, and the effect of departures from the perfect cycle is illustrated by the Joule, Otto, Diesel, and Rankine cycles. The uses of entropy diagrams and refrigeration cycles are also considered.

422. Heat Engineering. R. C. Wiren.
Course 3, III Year; 1 hr. lecture per week, both terms.
Internal combustion engines. Types and operation; performance and testing; basic characteristics and principles of design; carburetion; fuel injection; governing.
Steam Turbines. Types and basic characteristics; condensers; cooling towers.
Reference books: Elementary Heat Engines—Solberg, Cromer and Spalding. Internal Combustion Engines—Polson, Maleev, Jennings and Obert. Steam Turbines—Church.
Course 3, III Year; 1 hr. lecture per week, first term.
Steam generators and plant. Combustion calculations; analysis of fuels and products of combustion; boiler tests and heat balance; principles of design and commercial types of boilers, furnaces,

stokers, pulverized fuel equipment, economizers, air heaters, superheaters, etc.

Text book: Heat Engines—Allen and Bursley.

Reference book: Elementary Heat Power—Solberg, Croner and Spalding.

Course 3, III Year; 1 hr. lecture per week, second term.

Air conditioning. Air and water vapour mixtures; requirements for comfort and industrial processes; the use of psychrometric charts; heat transmission calculations; heating, cooling, humidifying, and dehumidifying processes; calculation of air conditioning loads; air conditioning systems and equipment.

Text book: Air Conditioning—Holmes.

Reference book: Heating and Air Conditioning—Allen, Walker and James.

423. Heat Engine Laboratory. R. C. Wiren, W. T. Thompson.

Courses 3, 5r, and 10, III Year; 1 three-hr. laboratory period per week, both terms.

Course 7, III Year; 1 three-hr. laboratory period per week, first, term.

Course 11, III Year; 1 three-hr. laboratory period per week, second term.

Mechanical Experiments. I. W. Smith.

Included in above.

Heat Transfer Experiments. F. G. Ewens.

Included in above.

A laboratory subject designed to assist in a clearer understanding of thermodynamics, machine design, and mechanics of machinery. The work on heat engines includes the setting of slide valves, measuring indicated and brake horse-power, and testing of air compressors, blowers, steam engines and internal combustion engines under various conditions, analysis of fuels and products of combustion, fuel calorimetry, steam calorimetry, etc.

The mechanical laboratory work deals with testing of belts and lubricating oils, and experiments on balancing of rotating masses. The heat transfer laboratory work deals with testing of insulation, heat exchangers and air conditioning equipment.

424. Heat Power Engineering. R. C. Wiren.

Courses 3 and 5r, IV Year; 2 hrs. lectures per week, first term; 1 hr. lecture per week, second term.

A continuation of lecture course 421. Properties of working substances; transitional stages from liquid to vapour to gas; calculations involving variable specific heats; insulation and heat transfer; refrigeration; power plant cycles including reciprocating engines and turbines; cycles for high pressures and temperatures;

superheating, reheating, regeneration, and binary- uid cycles; steam generators employing forced circulation, indirect evaporation and pressure combustion; power plant heat balance and efficiencies; steam turbines.

425. Internal Combustion and Aircraft Engines. E. A. Allcut.

Courses 3, 5r and 10, IV Year; 1 hr. lecture per week, both terms.

The difference between the efficiencies theoretically attainable and those actually achieved in internal combustion engines is examined in detail. The properties of the fuels used in gasoline and Diesel engines, the methods of testing them, and the various heat losses are described. Some consideration is also given to supercharging, detonation, cooling, and similar practical problems.

426. Heat Engine Laboratory. R. C. Wiren, B. D. Wood.

Courses 3 and 5r, IV Year; average 5½ hrs. laboratory work per week, both terms.

Heat Transfer Experiments. F. G. Ewens.

Included in above.

Mechanical Experiments. I. W. Smith.

Included in above.

A continuation and extension of the work covered in the III Year laboratory subject. Complete tests are made of heaters and of engines of various types such as simple, compound and uniflow steam engines, steam turbines, refrigerating machines, injectors, gas, Diesel and gasoline engines, air conditioning equipment, etc. and an analysis is made of the thermal cycles involved. A complete set of experiments is made in each case and the results plotted to show clearly to the student the effect of various alterations in adjustment on the results obtained. A complete boiler test is performed and all calculations are made for a heat balance. Experiments are performed on balancing of rotating masses.

427. Theory of Heat Engines. R. C. Wiren.

Courses 1 and 8, III Year; Course 2, IV Year ; 1 hr. lecture per week, both terms.

Thermodynamics of gases and vapours as applied to heat engine cycles and exemplified by internal combustion engines, air compressors, steam engines and turbines, and refrigerating plants.

Reference book: Elementary Engineering Thermodynamics—Young and Young.

428. Heat Engine Laboratory. R. C. Wiren, W. T. Thompson.

Course 1, III Year; eight 3-hr. laboratory periods, second term.

Course 6, III Year; average 1½ hrs. laboratory per week, second term.

Course 8, III Year; 1½ hrs. laboratory per week, second term.
Course 8a, III Year; 1½ hrs. laboratory per week, second term.
Course 2, IV Year; 1½ hrs. laboratory per week, first term.
Experiments with steam and internal combustion engines, compressed air, etc.

429. Heat Transfer and Refrigeration. F. G. Ewens.
Course 5r, IV Year; 2 hrs. lectures per week, both terms.
Refrigeration cycles and properties of refrigerants; flow of fluids and heat transfer; heat insulation; refrigerating machines and controls; air conditioning; cold storage; ice manufacture; industrial applications of refrigeration.

HYDRAULICS AND FLUID MECHANICS

440. Hydraulics. G. R. Lord, L. E. Jones, D. G. Huber, W. J. Laari.
Courses 1, 3, 6, 7, and 11, III Year; 2 hrs. lectures per week, both terms.
Course 2, III Year; Course 8a, IV Year; 2 hrs. lectures per week, first term.
Attention is given to the development and discussion of the fundamental principles of fluid flow. These principles are illustrated by suitable practical problems connected with fluid measurements, flow of water and other fluids in pipes, open channel computations; with a brief discussion of the resistance of submerged bodies, dimensional analysis and similarity studies.
Text book: Elementary Fluid Mechanics—Vennard.

441. Hydraulic Laboratory. G. R. Lord, L. E. Jones, D. G. Huber.
Courses 1, 3, 7, and 11, III Year; one 3 hr. laboratory period per week, second term.
Courses 2 and 6, III Year; six 3 hr. laboratory periods, first term.
Course 8a, IV Year; one 3 hr. laboratory period per week, first term.
This laboratory course is planned to illustrate the principles considered in the lecture courses in hydraulics. Experimental work in the laboratory utilizes a wide variety of apparatus and equipment concerned with fluid flow, while problems undertaken in the study room provide a link with general hydraulic practice.

442. Hydraulics. G. R. Lord.
Course 3, IV Year; 1 hr. lecture per week, both terms.
The various problems of unsteady flow such as occur in power plants, penstocks, etc. Much of the work is done by the process of arithmetic integration, and the lecture work is supplemented by problems solved by the students in the work rooms, the time for which is included in subject 444. Surges, water hammer, stream flow data, etc., are discussed.

The problems of collection of water for power purposes, use of the mass curve, rainfall and evaporation, etc., are also treated as far as possible. The flow of gases and vapours is also discussed.

443. Hydraulics. G. R. Lord.

Course 3, IV Year; 1 hr. lecture per week, first term; 2 hrs. lectures per week, second term.

Theory and design of turbines, pumps, fans, propellers, and other hydraulic machinery, as well as the application of hydraulic systems to aircraft and machine tools. The selection of turbines, pumps, and fans is dealt with, as well as problems related to the mechanical parts of hydraulic power plants. Cavitation in connection with pumps, turbines, and propellers is fully discussed.

444. Hydraulic Laboratory. G. R. Lord, L. E. Jones, D. G. Huber.

Courses 1e and 3, IV Year; average of 5½ hrs. laboratory per week in 3 and 2 hr. periods, both terms.

Experimental work is carried out in the laboratory on various types of pumps, turbines, fans, centrifugal compressors and on hydraulic models. In addition computation problems involving open channel flow, water power studies, pumps and turbine studies, water hammer phenomena and other advanced flow problems are considered. General problems involving compressibility of gases are considered.

445. Hydraulics. G. R. Lord.

Course 1, IV Year; 1 hr. lecture per week, both terms.

General hydraulic problems such as surges in pipe lines, water hammer, flow in open channels and backwater, mass curves and a general discussion of pumps.

446. Hydraulic Laboratory. G. R. Lord, L. E. Jones, D. G. Huber.

Course 1, IV Year; one 3 hr. laboratory period per week, first term.

Experimental studies of hydraulic models, turbines and pumps are carried out. Problems assigned in the study rooms deal with channel flow and other hydraulic features connected with water power installations, flood control, water supply and drainage systems.

447. Elementary Hydraulics. The Staff in Mechanical Engineering.

Courses 1, 3, 6, 7, 8, 8a and 11, II Year; 1 hr. lecture per week, first term.

Fluid properties. Theorems of fluid statics. Pressure-density-height relationships. Measurement of pressure intensity. Fluid

thrust on submerged surfaces. Buoyancy and flotation.

Text book: Elementary Fluid Mechanics—Vennard.

448. Mechanical and Thermal Measurements. The Staff in Mechanical Engineering.

Courses 2, 3, 6, 7, 8, 8a, 9 and 11, I Year; 1 hr. lecture per week, both terms.

An introduction to common engineering quantities, and means of measuring them. Dimensions, units, standards, length, area, angle, etc. Time, speed, acceleration, etc. Mass, pressure, specific gravity, power, etc. Temperature, heat quantity, expansivity, etc.

449. Treatment of Technical Data. L. E. Jones, W. J. Laari.

Course 3, II Year; 2 hrs. lectures per week, second term.

Presentation of data; approximate nature of technical data; role played by mathematics; general numerical methods; methods of organizing data for computation; methods of analysing technical data; elements of curve-fitting and statistical treatment.

451. Hydraulics. G. R. Lord.

Course 2, IV Year; 1 hr. lecture per week, second term.

Pumping and drainage problems connected with the operation of mines and mining properties.

452. Aircraft Hydraulics. A. S. Foreman.

Course 10, IV Year; 1 hr. lecture per week, first term.

A discussion of the numerous aircraft services that require remotely controlled power operation which can best be performed hydraulically. The basic principles underlying the design of aircraft hydraulic systems are considered in order that the student may understand present systems and master sufficient of the fundamental theory to enable him to follow future design.

Text book: Aircraft Hydraulics—Adams.

MACHINERY

461. Mechanical Engineering. The Staff in Mechanical Engineering.

Course 3, II Year; 2 hrs. lectures per week, first term.

Materials of design and production methods. In addition, standards, tolerances, limits, fits, and mechanical drafting room practice will be explained.

Text books: Drawings and Drafting Room Practice. A.S.A. Manufacturing Processes—Begeman.

462. Elementary Machine Design. The Staff in Mechanical Engineering.

Courses 6, 7, 8 and 8a, II Year; 2 hrs. lectures per week, second term.

A preparatory subject intended to familiarize the student with the different shop methods and processes, casting, forging, machin-

ing, etc., used in the production of machine parts, to enable him to make proper provision in the design of such parts to facilitate their production.

In addition, the various standards, machine and pipe threads, tapers, pipe fittings, etc., are described and mechanical drafting room practice explained. Tolerances, limits, fits and gauges are discussed.

Text book: Factory Equipment—Roe and Lytle. Drawings and Drafting Room Practice. A.S.A.

463. Machinery. R. T. Waines.

Course 1, III Year; 2 hrs. lectures per week, first term.

Design and selection of various machine elements, with particular reference to their application to bridges, shovels and other machinery affecting civil engineers.

Text book: Design of Machine Elements—Faires.

464. Machine Design Laboratory. W. G. McIntosh, I. W. Smith, R. T. Waines.

Course 1, III Year; 3 hrs. laboratory per week, first term.

The work in the laboratory and the drafting problems assigned will illustrate the lecture subject.

465. Theory of Machines A. The Staff in Mechanical Engineering.

Courses 3 and 10, II Year; 2 hrs. lectures per week, both terms.

A study of basic machine components, including the standard linkages, cams, gearing, and gear trains, with reference to practical applications. Methods for analysis of velocity, acceleration, and force distribution in machines. Effects of friction and determination of efficiency. The plotting and use of crank effort and torque diagrams.

Text book: Mechanism—Prageman.

466. Theory of Machines B. I. W. Smith.

Course 3, III Year; 2 hrs. lectures per week, first term.

A consideration of inertia forces and their effect in machines. Fluctuation of machine speed and its control by flywheels and governors. Balancing of rotating parts, engine balance, elementary vibration.

A working knowledge of velocity, acceleration, and force analysis is essential in this course.

Reference books: Theory of Machines—Angus. Mechanics of Machinery—Ham and Crane. Internal Combustion Engines—Degler. Vibration Analysis—Myklestad.

467. Machine Design. W. G. McIntosh.

Courses 3, 10, and 11, III Year; 2 hrs. lectures per week, both terms.

The design of various machine elements, including screw threads for fastening and power transmission, shafting, bearings (journal, thrust, ball, and roller) belts, pulleys, spur gears, flywheels, keys, clutches, etc.

Text book: Design of Machine Elements—Faires.

468. Machine Design and Mechanics of Machinery Laboratory. W. G. McIntosh, I. W. Smith, R. T. Waines.

Course 3, III Year; an average of 7½ hrs. laboratory per week, both terms.

Course 7, III Year; 3 hrs. laboratory per week, second term.

Course 10, III Year; 6 hrs. laboratory per week, both terms.

Course 11, III Year; 3 hrs. laboratory per week, both terms.

The work in the laboratory will consist of analytical and graphical solution of problems illustrating the principles involved in the lecture course in Mechanics of Machinery, and the design of machine parts covered in the lecture course in Machine Design. The object of the work on the drafting board is with a view to developing the students' judgment and sense of proportions in design and the application of drafting room standards.

469. Machine Design. R. T. Waines.

Courses 2, 6, 8 and 8a, IV Year; 1 hr. lecture per week, both terms.

The design of various machine elements, particularly those likely to be met with in chemical and metallurgical plants, and in mining work.

Text book: Design of Machine Elements—Faires.

470. Machine Design Laboratory. W. G. McIntosh, I. W. Smith, R. T. Waines.

Courses 2, 6, 8 and 8a, IV Year; 3 hrs. laboratory per week, second term.

Problems worked out in the laboratory, designed to give the student training in the general lay-out of shafting and plant machinery, as well as in the design of simple parts for chemical and metallurgical apparatus, and mine machinery.

471. Machine Design. S. Rodwin.

Course 5, II Year; 1 hr. lecture per week, both terms.

Some acquaintance with the selection of materials and their use in the design and construction of machinery. Machine parts are analysed as to suitable materials, production methods, and the nature and magnitude of the stresses encountered.

Text book: Design of Machine Elements—Faires.

472. Machine Design Laboratory. W. G. McIntosh, I. W. Smith, R. T. Waines, S. Rodwin.

Course 5, II Year; 3 hrs. laboratory per week, both terms.

The work in the laboratory will consist of the analytical solution of problems, illustrating the principles involved in the lecture course, and the standard practice in making assembly and detail machine drawings.

473. Machine Design. W. G. McIntosh.

Course 3, IV Year; 2 hrs. lectures per week, both terms.

Design of machine frames, hooks, hoisting equipment, crank shafts, gears of various kinds (helical, herringbone, bevel, screw, worm), springs, clutches, brakes, thin and thick wall vessels. An introduction will be given to the study of dynamic problems connected with the motor car, Diesel engine, and other high speed machinery.

Text book: Design of Machine Elements—Faires.

474. Advanced Machine Design Laboratory. W. G. McIntosh, I. W. Smith, R. T. Waines.

Course 3, IV Year; 5 hrs. laboratory per week, first term; 6 hrs. laboratory per week, second term.

Work in the laboratory devoted to the design of complete machines, with the object of giving the student practice not only in the design of various details, but also in working the various elements into a machine of smooth and harmonious design. The machines chosen as examples for design involve as many new machine elements as possible, in order to broaden the training of the student.

The work in the laboratory also involves special shafting problems, including graphical solutions, critical speeds, and multiple supports.

475. Machine Design. I. W. Smith.

Course 7, III Year; 2 hrs. lectures per week, both terms.

Principles of stress analysis and the design of various machine elements, including screw threads, shafting, bearings, belts, gears, flywheels, etc.; also an introduction to work on speed fluctuation and balancing.

Text book: Design of Machine Elements—Faires.

476. Manufacturing Processes.

Courses 11, IV Year; 2 hrs. lectures per week, both terms.

A study of metal casting, mechanical working, welding, heat treating, plastics and ply-wood moulding, finishes, machining, and mass production engineering.

477. Manufacturing Processes Laboratory.

Course 11, IV Year; 3 hrs. laboratory per week, both terms.

Design of castings and forgings and the selection of suitable manufacturing processes from raw material through forming, machining, mass production tooling, gauging, and finishing.

MATHEMATICS

490. Calculus. I. R. Pounder, H. R. Coish, J. J. DelGrande, T. E. Hull, J. N. P. Hume, L. Lucas, A. M. Sheppard, N. Shklov, H. Sussman, H. Wolf.

Courses 1, 2, 3, 4, 6, 7, 8, 8a, 9 and 11, I Year; 2 hrs. lectures per week, both terms.

Course 7, I Year, one 3 hr. period per week, both terms, for problems.

Derivation of the fundamental formulæ of the differential and integral calculus, with early applications to simple problems concerning graphs, areas, volumes, lengths, centres of gravity, and moments of inertia. Problems are dealt with in the drafting room as outlined in subjects 275, 276, 277, 278, 279, 280, 281, 282, and 283. For Course 7, an additional period of three hrs. per week is provided for problems and exercises, conducted by the Department of Mathematics.

491. Calculus. J. D. Burk, H. R. Coish, J. J. DelGrande, L. Lucas, N. Rostoker, A. M. Sheppard, N. Shklov, K. Shimizu, R. A. Staal, H. Sussman, D. G. Wertheim, H. Wolf.

Courses 1, 3, 6, 7, 8, and 11, II Year; 2 hrs. lectures per week, both terms.

Course 7, II Year; one 3 hr. period per week, both terms, for problems.

Continuation of subject 490. The elementary theory reviewed and extended. Special attention to applications with problems in engineering mostly in view. Introduction to the study of simple differential equations. Problems are dealt with in the drafting room as outlined in subjects 284, 285, 286, 287, 288, and 289. For Course 7, an additional period of three hrs. per week is provided for problems and exercises, conducted by the Department of Mathematics.

492. Analytical Geometry. I. R. Pounder, H. R. Coish, J. J. DelGrande, T. E. Hull, J. N. P. Hume, L. Lucas, A. M. Sheppard, N. Shklov, H. Sussman, H. Wolf.

Courses 1, 2, 3, 4, 6, 7, 8, 8a, 9 and 11, I Year; 1 hr. lecture per week, first term, 2 hrs. per week, second term.

The work in Elementary Analytical Geometry covers the more familiar propositions in connection with the straight line, circle, parabola, ellipse, and hyperbola. The subject is treated to illustrate

the general methods of analytical geometry. Introduction to Analytical Geometry of Three Dimensions. In addition problems are dealt with in the drafting room as outlined in subjects 275, 276, 277, 278, 279, 280, 281, 282, and 283. A part of the problem time for Course 7 listed under subject 490 is devoted to problems in analytical geometry.

493. Spherical Trigonometry. G. T. Horton.

Course 1, II Year; 1 hr. lecture per week, first term.

The derivation of formulæ and their application to the solution of triangles and to practical problems.

Text books: Spherical Trigonometry—Todhunter and Leatham Printed Lecture Notes—J. W. Melson.

494. Least Squares. G. T. Horton.

Course 1, II Year; 1 hr. lecture per week, second term.

The general principles of probability, the law of error, direct measurements of equal and different weights; mean square and probable errors; indirect measurements; conditioned observations; applications to empirical constants and formulæ, etc.

Text books. Least Squares—Merriman. Printed Lecture Notes —J. W. Melson.

502. Algebra and Calculus. Mrs. R. Brauer, Mrs. L. Infeld.

Courses 5 and 10, I Year; 3½ hrs. lectures per week, both terms.

Polynomials and rational functions, elementary theory of equations, inequalities, determinants, limits, summation of series, binomial, exponential, and logarithmic series, expansions of the circular and hyperbolic functions and their inverses, the methods and operations of the Calculus considered intuitively and illustrated by applications, elementary differential equations.

Text books. Calculus—Sherwood and Taylor. Introduction to the Calculus—Beatty and Jenkins.

503. Analytical Geometry of the Plane. Mrs. R. Brauer, Mrs. L. Infeld.

Courses 5 and 10, I Year; 1½ hrs. lectures per week, both terms.

Cartesian and polar coordinates, transformation of coordinates, straight lines and curves of the second degree, projective properties of conics, the principle of duality, higher plane curves.

Text book: Analytical Geometry—Nowlan.

504. Differential Calculus. D. A. F. Robinson, J. A. Rottenberg.

Courses 5 and 10, II Year; 3 hrs. lectures per week, both terms.

Differentiation, Taylor's theorem and series for functions of one or more variables, families of curves and surfaces and their differential equations, Jacobians, geometrical and mechanical applications.

Text book: Advanced Calculus—Sokolnikoff.

505. Integral Calculus and Differential Equations. W. J. Webber, G. P. Henderson.

Courses 5 and 10, II Year; 3 hrs. lectures per week, both terms.

The indefinite integral, integration of rational and other special functions, the definite integral, differentiation with respect to a parameter, multiple integration, Fourier's series, geometrical and mechanical applications, approximate integration, introduction to ordinary differential equations.

Text book: Advanced Calculus—Sokolnikoff.

506. Analytical Geometry of Space. R. A. Staal.

Courses 5 and 10, II Year; 1 hr. lecture per week, both terms.

Cartesian and other systems of point coordinates, curves and surfaces and their equations in parametric or non-parametric form, data fixing planes, lines, conics, and quadrics, generating lines and circular sections of quadrics, classification of quadrics, tangent cones to quadrics, metric and projective properties of quadrics, families of quadrics, ruled surfaces and surfaces of revolution.

Text book: Coordinate Geometry—Eisenhart.

507. Differential Equations. Miss C. C. Krieger.

Course 1, III Year; 1 hr. lecture and 1 hr. problem work per week, both terms.

First order equations, solvable by quadratures, linear equations of first and second order, linear equations with constant coefficients of higher order, solution in series, Fourier's series.

Text books: Elementary Differential Equations—Kells. Differential Equations—Reddick.

508. Theory of Functions. Miss C. C. Krieger.

Courses 5 and 10, III Year; 1 hr. lecture and 1 hr. problem work per week, both terms.

Complex numbers, limits and series, analytic functions, Cauchy's theorem, Taylor and Laurent series, singularities and their significance, analytic continuation, contour integration, conformal mapping of one plane region on another.

Text books: Functions of a Complex Variable—Phillips. Theory of Functions—Copson. Theory of Functions as applied to Engineering Problems—Rothe, Ollendorff, and Pohlhausen.

509. Differential Equations. Miss C. C. Krieger.

Courses 5 and 10, III Year; 1 hr. lecture and 1 hr. problem work per week, both terms.

First order equations solvable by quadratures, depression of the order, the linear equation, the linear equation with constant coefficients, operator methods, the linear partial differential equation, particular equations of the second order.

Text books: Differential Equations—Piaggio. Intermediate Differential Equations—Rainville. Fourier Series and Boundary Value Problems—Churchill.

MATHEMATICS, APPLIED

520. Theoretical Mechanics. G. deB. Robinson.

Course 5, III Year; 1 hr. lecture and 1 hr. problem work per week, both terms.

A systematic application of mathematical methods to the solution of problems in mechanics, with emphasis on general principles. The problems deal chiefly with the plane motion of particles and rigid bodies. Lagrange's equations are introduced.

Text book: Principles of Mechanics—Synge and Griffith.

521. Differential Equations of Mathematical Physics. A. F. Stevenson.

Courses 5 and 10, IV Year; 2 hrs. lectures per week, both terms.

The underlying theory and important particular equations, including eigenvalues and eigenfunctions, Fourier series, spherical and cylindrical harmonics, vibration of strings, membranes, and rods, sound waves, water waves, equation of heat conduction.

METALLURGY

530. Metallurgy. L. M. Pidgeon.

Course 8, II Year; Courses 2 and 9, III Year; 1 hr. lecture per week, first term.

An introductory course describing the theory and practice of metallurgical operations.

531. Fuels and Combustion. J. E. Toomer.

Courses 8 and 8a, II Year; 1 hr. lecture per week, both terms.

Fuels, their use, preparation, calorific value, and combustion.

532. Physical Metallurgy.

Course 11, II Year; Courses 3, 5, 7, and 8a, III Year; 2 hrs. lectures per week, second term.

General physical metallurgy, including the common engineering alloys.

534. Metallurgy. L. M. Pidgeon.

Course 8, III Year; 2 hrs. lectures per week, first term; 1 hr. lecture per week, second term.

A general discussion of the fundamental principles of metallurgy, including the production of the more important metals. Metallurgical problems are included in this course.

535. Metallurgy Laboratory. J. E. Toomer.

Course 8, III Year; 6 hrs. continuous laboratory per week, both terms.

Experiments in roasting, smelting, leaching, and retorting.

536. Physical Metallurgy.
Course 8, III Year; 2 hrs. lectures per week, both terms.
The physical metallurgy of the common alloys; equilibrium diagrams. Pyrometry.

537. Metallography Laboratory.
Course 8, III Year; 3 hrs. laboratory per week, both terms.
The use of the microscope. The preparation of alloys. Pyrometry.

538. Metallurgy. L. M. Pidgeon.
Course 2, IV Year; 1 hr. lecture per week, both terms.
Calculations necessary to understand metallurgical processes.

539. Metallurgy Laboratory. J. E. Toomer.
Course 2, IV Year; 6 hrs. continuous laboratory per week for one half of second term.
Similar to subject 535.

540. Metallurgy Problems. L. M. Pidgeon.
Course 8, IV Year; 2 hrs. lectures per week, both terms.
Problems of chemical reactions, thermochemistry, electrolysis, vapor pressure, transmission of heat, etc.

541. Metallurgy Laboratory. J. E. Toomer.
Course 8, IV Year; 6 hrs. continuous laboratory per week, first term; 3 hrs. laboratory per week, second term.
Metallurgical analyses of ores, furnace products, and alloys.

542. Metallurgy. L. M. Pidgeon.
Course 8, IV Year; 1 hr. lecture per week, both terms.
Critical reading and discussion of papers, describing metallurgical processes or dealing with plant arrangement and construction.

543. Physical Metallurgy.
Courses 6m and 8, IV Year; 2 hrs. lectures per week, both terms.
A continuation of subject 536, dealing more particularly with the ferrous alloys. Part of the lectures consist of discussions of photo-micrographs.

544. Metallography Laboratory.
Course 8, IV Year; 3 hrs. laboratory per week, both terms.
Specimens of the common alloys are prepared, microscopically examined, and photographed.

545. Physical Metallurgy. W. L. Sagar.
Course 8, IV Year; 3 hrs. laboratory per week, first term.
The introductory part of this subject is intended to give some familiarity with the experimental study of the elastic and physical properties of iron and steel, and in the use of testing machines and

instruments of precision designed for that purpose. Following this, carbon and alloy steels are given different heat treatments. The structures developed are examined and photographed, mechanical tests are made and findings correlated.

546. Physical Metallurgy.

Courses 1, 2, 6, and 9, III Year; 1 hr. lecture per week, second term.

The mechanical properties and heat treatment of steel; cast-iron.

547. Heat Treatment of Iron and Steel.

Courses 3 and 11, IV Year; 1 hr. lecture per week, both terms.

The principles underlying the heat treatment and mechanical treatment of carbon and alloy steels. Cast iron.

548. Heat Treatment of Iron and Steel Laboratory.

Courses 3 and 11, IV Year; 1½ hrs. laboratory per week, second term.

Preparation of specimens of steels and irons, and examining them microscopically.

549. Physical Metallurgy Laboratory.

Courses 2 and 9, III Year; 1 hr. laboratory per week, second term.

Specimens of the common alloys are prepared and microscopical examined.

550. Metallurgical Theory. W. C. Macdonald.

Course 8, IV Year; 1 hr. lecture per week, both terms.

A study of equilibria at high temperatures in production metallurgy.

551. Aircraft Materials. L. M. Pidgeon.

Course 10, IV Year; 1 hr. lecture per week, both terms.

Alloys of magnesium and aluminum, high strength steels, castings and forgings, together with wood and plastics, as used in aircraft construction.

CERAMICS AND NON-METALLIC MINERALS

560. Non-Metallic Minerals. P. M. Corbett.

Course 8a, III Year; 3 hrs. lectures per week, first term; 2 hrs. lectures per week, second term.

Industrial classification, properties, and utilization of non-metallic minerals. Ceramic plant practice is covered in some detail in the second term.

561. Non-Metallic Minerals Laboratory. P. M. Corbett.

Course 8a, III Year; 6 hrs. laboratory per week, both terms.

The physical properties and thermal characteristics of non-metallic minerals are studied from an industrial standpoint.

562. Ceramics. P. M. Corbett.
Course 8a, III Year; 2 hrs. lectures per week, second term.
The composition of clear and coloured glazes.

563. Ceramic Calculations. J. E. Toomer.
Course 8a, IV Year; 1 hr. lecture per week, first term.
Lectures and problems on calculations necessary for the compounding of ceramic bodies and glazes.

564. Ceramics Laboratory. J. E. Toomer.
Course 8a, III Year; 6½ hrs. laboratory per week, first term; 7 hrs. laboratory per week, second term.
Practice in the analysis of non-metallic minerals.

565. Refractories and Ceramic Bodies. P. M. Corbett.
Course 8a, IV Year; 1 hr. lecture per week, first term; 2 hrs. lectures per week, second term.
Composition of bodies made by using non-metallic minerals, with special reference to refractories, whiteware, and porcelain.

566. Glass and Enamels. P. M. Corbett.
Course 8a, IV Year; 1 hr. lecture per week, both terms.
Composition and manufacture of glass and iron enamels.

568. Industrial Minerals Laboratory. P. M. Corbett.
Course 8a, IV Year; 6 hrs. laboratory per week, both terms.
Advanced work on the compounding and testing of non-metallic mineral products.

569. Building Materials; Ceramic. P. M. Corbett.
Course 4, IV Year; 1 hr. lecture per week, both terms.
Composition, manufacture, properties, and use of ceramic building materials.

570. Glass Technology. P. M. Corbett.
Course 6c, IV Year; 2 hrs. lectures per week, first term; 1 hr. lecture per week, second term.
A consideration of chemical reactions at high temperature, based upon the composition and properties of various glasses.

571. Glass Technology Laboratory. P. M. Corbett.
Course 6c, IV Year; 6 hrs. laboratory per week, first term; 19 hrs. laboratory per week, second term.
Based upon subject 570.

572. Introductory Ceramics. P. M. Corbett.
Course 8a, II Year; 2 hrs. lectures per week, first term.
A descriptive course to cover all the branches of the ceramic industry.

GEOLOGICAL SCIENCES

MINERALOGY AND PETROGRAPHY

580. Elementary Mineralogy. R. M. Thompson, E. W. Nuffield.
Courses 2 and 9. I Year; 2 hrs. lectures per week, second term.
Course 5g, III Year; 2 hrs. lectures per week, first term.
An introductory course in general and descriptive mineralogy.
Text book: Dana's Manual of Mineralogy—Hurlbut.

581. Elementary Mineralogy Laboratory. R. M. Thompson, E. W. Nuffield.
Courses 2 and 9, I Year; 1 hr. laboratory per week, second term.
Course 5g, III Year; 1 hr. laboratory per week, first term.
A practical course to accompany subject 580.
Reference book: Dana's Manual of Mineralogy—Hurlbut.

583. Introductory Mineralogy. R. M. Thompson.
Courses 6, 8 and 8a, I Year; 2 hrs. lectures and laboratory per week, second term.
A brief study of the common minerals.
Reference book: Dana's Manual of Mineralogy—Hurlbut.

585. Lithology. R. M. Thompson, V. B. Meen.
Courses 2 and 9, II Year; Course 5g, III Year; 1 hr. lecture and laboratory per week, both terms.
A macroscopic study of rock-forming minerals and rocks.
Text book: Handbook of Rocks—Kemp-Grout.

587. Blowpipe Analysis. R. M. Thompson.
Courses 2 and 9, II Year; 2 hrs. laboratory per week, first term.
Determination of minerals by means of the blowpipe and from physical properties.
Reference book: Dana's Manual of Mineralogy—Hurlbut.

589. Elementary Optical Mineralogy. V. B. Meen.
Courses 2 and 9, II Year; Courses 5g and 8a, III Year; 1 hr. lecture and laboratory per week, second term.
Reference book: Optical Mineralogy—Rogers and Kerr.

590. Petrology Laboratory. V. B. Meen.
Course 2, III Year; 2 hrs. laboratory per week, second term.
Continuation of subject 585, with some consideration of the microscopic properties of minerals and rocks.
Text book: Petrology for Students—Harker.

592. Lithology. V. B. Meen.
Course 1, III Year; 2 hrs. lectures and laboratory per week, first term.
A study of rocks and rock-forming minerals.
Text book: Handbook of Rocks—Kemp-Grout.

594. Petrography. W. W. Moorhouse.
Course 9, III Year; Course 5g, IV Year; 1 hr. lecture per week, both terms.
Microscopic characters of the rock-forming minerals in thin sections, and description and classification of rocks, continuing subjects 585 and 589.
Text books: Optical Mineralogy—Rogers and Kerr. Petrology for Students—Harker.

595. Petrography Laboratory. W. W. Moorhouse.
Course 9, III Year; Course 5g, IV Year; 2 hrs. laboratory per week, both terms.
Microscopic petrography, to accompany subject 594.
Text books: As in subject 594.

596. Optical Mineralogy Laboratory. M. A. Peacock.
Courses 8a and 9, IV Year; 2 hrs. laboratory per week, both terms.
Determination of the non-opaque minerals by the immersion method.
Reference books. Optical Crystallography—Wahlstrom. The Microscopic Determination of the Non-opaque Minerals—Larsen and Berman.

597. Mineralography Laboratory. R. M. Thompson.
Course 9, IV Year; 2 hrs. laboratory per week, both terms.
A study of the common ore minerals in polished sections.
Reference book: Microscopic Determination of the Ore Minerals —Short.

598. Morphological Crystallography. M. A. Peacock.
Course 5s, IV Year; 1 hr. lecture per week, both terms.
A course on the thirty-two crystal classes, with reference to natural and artificial crystals.
Text book: The Form and Properties of Crystals—Dale.

MODERN LANGUAGES

610. English. W. J. T. Wright.
All courses, I Year; 1 hr. lecture per week, both terms.
The expression of ideas and the compilation and writing of engineering reports and letters; technical exposition; the necessity of accurate expression in professional writing; the value of reading.

613. German. T. Hedman.
Course 6, II Year; 1 hr. lecture per week, both terms.

614. German. T. Hedman.
Course 6, III Year; 1 hr. lecture per week, both terms.
An advanced course in scientific German.

615. German. T. Hedman.

Course 6, IV Year; 1 hr. lecture per week, both terms.

An advanced course in scientific German. Translation of scientific articles and treatises.

PHYSICAL TRAINING

640. Physical Training.

All courses, I and II Years.

The requirements for Physical Training are outlined in Section XIV.

PHYSICS

650. Properties of Matter; Mechanics and Heat. A. D. Misener.

Courses 5 and 10, I Year; 4 hrs. lectures, per week, both terms.

In addition to the work in the divisions indicated in the title, the subject also includes lectures and problems on calculations for science students involving curve plotting and curve fitting, and the use of the elementary calculus and statistics.

Reference books: Dynamics—Duncan and Starling. Mechanics of Fluids—Barton. Mechanics—Sears. Properties of Matter—Wagstaff. Heat—Stewart and Satterly (ed. Archer). Heat—Noakes. Mathematical and Physical Tables—Clark. Calculus Made Easy—Thompson. Theory of Measurements—Tuttle and Satterly.

651. Properties of Matter; Mechanics and Heat Laboratory. A. D. Misener.

Courses 5 and 10, I Year; 3 hrs. laboratory per week, both terms.

Supplementary to subject 650.

652. Elementary Magnetism and Electricity. D. S. Ainslie.

Course 5, II Year; 1 hr. lecture per week, first term; 2 hrs. lectures per week, second term.

Fundamental theory of magnetism and electricity, including the introduction of electron theory and alternating currents.

Reference books: Advanced Text-book of Magnetism and Electricity—Hutchinson. Electricity and Magnetism—Starling.

653. Elementary Light. M. F. Crawford.

Courses 5 and 8a, II Year; 1 hr. lecture per week, both terms.

Fundamental theory of light, including treatment of interference, diffraction, polarized light, and the introduction of geometrical optics.

Reference books: Light for Students—Edser. Introduction to Physical Optics—Robertson. Optical Measuring Instruments—Martin.

654. Acoustics.

Course 5, II Year; 1 hr. lecture per week, first term.

Fundamental theory of acoustics, including elementary treatment of architectural acoustics.

655. Physics Laboratory (Magnetism and Electricity, Light and Acoustics).

Course 5, II Year; 3 hrs. laboratory per week, first term; 6 hrs. laboratory per week, second term.

Work carried out under the direction of the staff in Physics, covering lectures dealt with in subjects 652, 653 and 654.

656. Mathematical Operations Applied to Physics.

Course 5, III Year; 1 hr. lecture per week, both terms.

The application of vector analysis to physical problems, and an elementary treatment of Fourier Series, Spherical Harmonics, Bessel functions, etc.

657. Properties of Matter. John Satterly.

Course 5, III Year; 2 hrs. lectures per week, both terms.

Advanced work on properties of matter, dealing with gravitation, elasticity, viscosity, surface tension, and kinetic theory of gases.

Reference books: Properties of Matter—Poynting and Thomson. General Properties of Matter—Newman and Searle. Applied Mathematics—Perry. Experimental Physics—Searle. Practical Physics—Watson. The Mechanical Properties of Fluids—Drysdale and others.

658. Heat. John Satterly.

Course 5, III Year; 1 hr. lecture per week, both terms.

Thermometry and pyrometry; absolute scale of temperature, mechanical equivalent of heat, kinetic theory of gases, equations of state, low temperature work, specific heats, vaporization, fusion, expansion, transfer of heat by conduction and convection; radiation and radiation pyrometry, the second law of thermodynamics and its simple applications.

Reference books: Heat and Thermodynamics — Roberts. Methods of Measuring Temperature—E. Griffiths. A Textbook on Heat. Parts I and II—Allen and Maxwell.

659. Physical Laboratory.

Course 5, III Year; 3 hrs. laboratory per week, both terms.

Experiments illustrating the principles involved in the two preceding subjects.

660. Optics. R. Richmond.

Courses 5c, 5i, and 5s, III Year; 1 hr. lecture per week, first term.

Geometrical Optics. The theory of paraxial rays and aberrations in optical systems.

Reference books: Applied Optics and Optical Design, Part One —Conrady. The Principles of Optics—Hardy and Perrin. Fundamentals of Optical Engineering—Jacobs.

661. Optics. R. Richmond.

Courses 5c, 5i, and 5s, III Year; 3 hrs. laboratory per week first term.

Supplementary to subject 660.

662. Hydrodynamics.

Course 10, III Year; 1 hr. lecture per week, both terms.

Hydrodynamics of a perfect fluid, with applications to motion in liquids and gases. Reference will be made to some of the simpler cases of viscous flow. The course will be illustrated by experiments.

Text books: Treatise on Hydromechanics—Ramsay. Aerofoil and Airscrew Theory—Glauert. The Physics of Solids and Fluids—Ewald, Poschl and Prandtl. Hydro and Aeromechanics—Prandtl-Tietjens.

663. Introduction to Atomic and Molecular Physics. Miss E. J. Allin.

Courses 5c and 5s, IV Year; 1 hr. lecture per week, both terms.

Kinetic theory of gases, electrical discharge through gases, the electron, elementary X-rays and crystal structure, ionization, the development of radioactivity and its use in the physical and geological sciences.

Text book: The 'Particles' of Modern Physics—Stranathan.

Reference books: The Atom—Andrade. Radioactivity—Rutherford, Chadwick and Ellis. Heat—Poynting and Thomson. Kinetic Theory of Gases—Jeans.

664. Advanced Acoustics.

Courses 5c, 5s and 5i, IV Year; 1 hr. lecture per week, first term.

Properties and transmissions of acoustical waves. Analogies in alternating current theory and other fields in physics. Sound filters.

665. Physical Laboratory. H. J. C. Ireton.

Course 5c, IV Year; 3 hrs. laboratory per week, both terms.

Course 5s, IV Year; 9 hrs. laboratory per week, first term; 12 hrs. laboratory per week, second term.

Accompanying the lecture subjects 663, 664, 666, 667, 668, and 669.

666. Advanced Optics. M. F. Crawford.

Course 5s, IV Year; 1 hr. lecture per week, both terms.

Principles and applications of various types of spectroscopic instruments. Interference, diffraction, and polarisation; refractometers and polarimeters.

Text books: Applied Optics—Martin. Course d'Optique—Bruhat. The Diffraction of Light, X-Rays, Etc.—Meyer. Applied Optics and Optical Design—Conrady.

667. Atomic and Molecular Spectra. H. J. C. Ireton, H. L. Welsh.
Course 5s, IV Year; 1 hr. lecture per week, both terms.

Elementary atomic spectroscopy, origin of spectral lines and classification in series with applications.

Elementary molecular spectroscopy and structure of Molecules.

Reference books: Introduction to Modern Physics—Richtmyer and Kennard; Molecular Spectra and Molecular Structure—Herzberg.

668. Elementary Quantum Theory. Miss E. J. Allin.
Course 5s, IV Year; 1 hr. lecture per week, first term.

The fundamental principles of the quantum theory developed from a historical and experimental standpoint, radiation formulæ, photoelectric effect, Compton effect, specific heats.

669. Analysis of Materials by Spectrographic and X-Ray Methods.
Course 5s, IV Year; 1 hr. lecture per week, both terms.

Qualitative and quantitative methods of spectro-chemical analysis of materials. The physical properties of X-rays, their production and applications to crystal structure.

Reference books: Applied X-Rays—Clark. Chemical Spectroscopy—Brode. Optical Methods of Chemical Analysis—Gibb.

670. Exploration Geophysics. A. A. Brant, J. H. Hodgson.
Courses 5g and 9, IV Year; 2 hrs. lectures per week, both terms.

Physical principles underlying geophysical methods used in locating mineral deposits. Particular attention is given to magnetic, electrical, electromagnetic, gravitational, seismological, theremometric, and radioactive methods.

Reference books: Geophysical Exploration—Heiland. Exploration Geophysics—Jakosky. Imperial Geophysical Exploration Survey, Broughton—Edge and Laby. Applied Geophysics—Eve and Keys.

671. Geophysics. A. A. Brant, J. H. Hodgson.
Course 5g, IV Year; 9 hrs. laboratory per week, both terms.
Course 9, IV Year; 6 hrs. laboratory per week, both terms.

A laboratory course accompanying subject 670 to illustrate the physical principles and measurements involved in geophysical field work, the mapping and interpretation of survey data.

672. Physics of the Earth. J. T. Wilson, J. H. Hodgson.
Course 5g, IV Year; 2 hrs. lectures per week, both terms.

Basic considerations of gravitation; the figure of the earth and isostacy; terrestrial magnetism and atmospheric electricity; seismology; internal structure and constitution of the earth; radioactivity, geothermal heat and the age of the earth.

673. Physics of Light Production. H. J. C. Ireton.

Courses 5i and 5r, IV Year; 1 hr. lecture per week, both terms.

Black body radiation, spectral energy distribution, and the principles involved in the production of light in various types of sources, filament, flame, gaseous, and vapour tubes.

674. Physical Laboratory. H. J. C. Ireton.

Course 5i, IV Year; 3 hrs. laboratory per week, both terms.

Accompanying subject 673.

675. Heat. A. D. Misener.

Course 10, II Year; 1 hr. lecture per week, first term.

Thermometry and pyrometry, temperature scales, mechanical equivalent of heat, specific heat vaporization, fusion, expansion, transfer of heat, kinetic theory of gases and elementary thermodynamics.

Referencebooks: Heat and Thermodynamics—Roberts. Temperature Measurement and Control—Weber. Heat and Thermodynamics—Zemansky. Textbook of Heat, Parts I and II—Allen and Maxwell.

676. Physical Laboratory. A. D. Misener.

Course 10, II Year; 3 hrs. laboratory per week, first term.

Experiments illustrating the principles involved in Course 675.

PRACTICAL EXPERIENCE

690. Practical Experience.

Course 1.

Every student in Civil Engineering is urged to obtain the maximum amount of practical experience possible, during the summer vacations of his course. He must, before graduation, present satisfactory evidence of having had an experience of at least 600 hours on work acceptable to the Department. He is required to submit to the Department by the first day of the Session a report of not less than fifteen hundred words on the work in which he has been engaged during the summer. Failure to meet these requirements will result in a condition in practical experience.

During the present session, the submission of Reports to the Department will not be required. Notwithstanding this waiver, all students are urged to prepare Reports on their summer work for their own benefit and future record.

691. Practical Experience.

Course 2.

Every student in Mining Engineering is required to present, before graduation, satisfactory evidence of having had at least six months' practical experience in work connected with Mining, Metallurgy, or Geology, for which he must have received regular wages.

The time may be spent in geological survey, ore dressing, smelter, or lixiviation works, in prospecting, or on any work in or about a mine other than as an office man or clerk. Prospecting will count only one-half (e.g., four months' prospecting will be counted as two months) and must not be submitted for more than three of the six months. Not more than three months on geological surveys or in assaying will be accepted as part of the six months. It is important to note that this experience may be obtained before the student is admitted to the University.

692. Practical Experience.

Course 3.

Every student in Mechanical Engineering is required to spend 1200 hours in mechanical work satisfactory to the Department. Half of this work is required to be done before February of his Third Year and the balance before February of his Fourth Year. Proof is to be given the Department before the dates mentioned.

All or any part of this shop work may be completed before the student enters the University, and he is urged to complete all of it at as early a date in his course as possible.

Failure to meet the specified requirements within the time set will result in a condition in shop work.

Certificate forms for this work may be obtained from the Department of Mechanical Engineering.

(*a*) Third Year—600 hours.

The student is required to obtain this practical experience in industry, preferably in the foundry, the forge shop, and the machine shop. Such work assists the student in his understanding of the lecture and laboratory work throughout his entire course in Mechanical Engineering, and particularly the design work in his Third and Fourth Years.

Instruction regarding the type of work which is acceptable, and any special requirements, will be given by the Department to the student during his Second Year.

(*b*) Fourth Year—the balance of 1200 hours.

This is a continuation of the work outlined for the Third Year.

Instruction regarding the type of work which is acceptable, and any special requirements, will be given by the Department to the student during his Third Year.

693. Practical Experience.

Course 4.

Every student in the School of Architecture is required to spend at least 12 months (1,900 hrs.) in practical work and satisfactory evidence of its completion must be submitted before the granting of a degree. This work is done during the summer vacations, and

is normally done in an architect's office for the whole period of 12 months. A student may, on application to the School of Architecture, be given permission to spend up to 6 months of this period with an engineer, a recognized contractor, or other firm conducting work in connection with building. At least 6 months' practical work in a recognized architect's office is obligatory.

695. Practical Experience.

Course 7.

Every student in Electrical Engineering is required to submit, before graduation, satisfactory evidence of having had at least 1200 hours' experience in work connected with engineering practice. Certificate forms may be obtained from the Department of Electrical Engineering and the completed certificates should be returned to the Department as soon as possible after the completion of each period of work.

696. Practical Experience.

Course 9.

Every student in Mining Geology is required to submit, before graduation, satisfactory evidence that he has spent at least six months in field work. This work may consist of prospecting, work around mines, or service on geological field parties.

698. Practical Experience.

Course 11.

Each student in this course is required to spend 1200 hours doing practical work, before graduation. This time should preferably be spent in the actual performance of manufacturing or constructional operations in industrial plants or engineering enterprises. Such experience will be valuable in promoting a better understanding of lectures and laboratory work and will assist the student in appreciating the workers' viewpoint.

SURVEYING

All students taking Field Work in Courses 710 to 720, inclusive, will be required to use Departmental Field Books.

710. Surveying. W. M. Treadgold, T. L. Rowe, H. L. Macklin, G. T. Horton, L. A. Walker, R. G. Patterson.

Courses 1, 2, 3, 4, 5, 6, 7, 8, 8a, 9, 10 and 11, I Year; 1 hr. lecture per week, first term.

General principles and practice of surveying with the chain, the transit, and the level, with special attention given to co-ordinative surveying.

Text books: Plane Surveying—Tracy. Elementary Surveying—Breed and Hosmer. Surveying—Breed. Printed Notes on Elementary Surveying—The Staff in Surveying.

712. Field Work. W. M. Treadgold, T. L. Rowe, H. L. Macklin, G. T. Horton, L. A. Walker, R. G. Patterson.

Courses 1, 2, 3, 4, 5, 6, 7, 8, 8a, 9, 10 and 11, I Year; 3 hrs. per week, first term.

Practice in chaining; a complete survey of a piece of land with the chain and transit; keeping of field notes; the use of the transit in surveying closed figures and traverse lines, and in ranging straight lines; plotting by latitudes and departures and otherwise computing areas; instrumental work with the level; use of level and transit in setting out a proposed building and calculating the volume of excavations required.

714. Surveying. W. M. Treadgold, H. L. Macklin, G. T. Horton, L. A. Walker, R. G. Patterson.

Course 1, II Year; 1 hr. lecture per week, both terms.

Simple, reverse, and compound curves as applied to railroad and highway surveying. Stadia, plane table, and photographic surveying as applied to topographic work, and the main features of mine, hydrographic, and aerial surveying

Text books: Searles, Allen (Field books for Engineers). Theory and Practice of Surveying—Davis, Foote and Rayner. Surveying —Breed and Hosmer. Printed Lecture Notes—W. M. Treadgold.

715. Surveying. H. L. Macklin.

Courses 2 and 9, II Year; 1 hr. lecture per week, both terms.

Mine surveying, with problems related thereto. Simple curves, stadia and plane table topographical surveying.

Text books: Surveying—Breed and Hosmer. Mine Surveying —Durham. Introduction to Mine Surveying—Staley.

716. Field Work. W. M. Treadgold, H. L. Macklin, G. T. Horton, L. A. Walker, R. G. Patterson.

Course 1, II Year; 8 hrs. per week, first term.

Courses 2 and 9, II Year; 6 hrs. per week, first term.

Adjustments of the transit and level, minor problems in triangulation and traversing, levelling and plane table practice, curves and topography.

717. Construction Surveying. W. M. Treadgold.

Course 1, III Year; 1 hr. lecture per week, both terms.

Construction surveys are taken up under the following headings, and the work is treated as applying equally to railroads, highways, canals, transmission lines, etc.

Earthwork:

(*a*) Cross sectioning.

(*b*) Computation of volume.

(*c*) Mass or haul diagram.

Transition and Vertical curves (including super-elevation).

Railway turnouts and sidings.

Layout of roads and sewers.

Text books: Field Engineering—Searles. Railroad Curves and Earthwork—Allen. Route Surveying—Pickles and Wiley. Printed Notes—W. M. Treadgold.

718. Advanced Surveying. W. M. Treadgold, J. W. Melson.

Course 1b, IV Year; 2 hrs. lectures per week, second term.

Lectures in precise surveying in primary traverses, base line measurement, and field triangulation; determination of geodetic positions.

719. Advanced Surveying. W. M. Treadgold, J. W. Melson.

Course 1b, IV Year; 4 hrs. practical work per week, second term.

Adjustment of observations, application of Least Squares, and base line measurements.

720. Survey Camp. W. M. Treadgold, J. W. Melson, T. L. Rowe, H. L. Macklin, G. T. Horton, G. B. Langford, W. W. Moorhouse.

Courses 1, 2 and 9, III Year.

Course 1...........May 3 to May 31—Ajax or
Aug. 23 to Sept. 20—Dorset

Courses 2 and 9.....May 3 to May 31—Gull Lake or
Aug. 23 to Sept. 20—Gull Lake

This course includes:

(*a*) Secondary Triangulation and Base Line Measurements.
(*b*) Stadia, Plane Table and Boundary Traverses.
(*c*) Highway and Railway Location.
(*d*) Cross Sectioning and Computation of Earthwork.
(*e*) Hydrographic Surveying.
(*f*) Stadia and Plane Table Topography.
(*g*) Mine Surveying.
(*h*) Observations for Time, Azimuth, and Latitude.
(*i*) Geological Survey.

Students in Courses 1, 2 and 9 will be required to take the Survey Camp between the Second and Third Years; on failure to do so, this subject will be carried as a supplemental in the Third Year.

THESIS

730. Thesis.

Course 1, IV Year.

Each student of the Fourth Year, Course 1, is required to prepare and present a thesis on an approved subject, in both oral and written form. Instructions regarding the form of the thesis, and the selection of subject, are given to students at the end of their Third Year. The written thesis must be submitted not later than the last day of the Fall term of the Fourth Year of study. Oral presentation of the theses is arranged for the Spring term during regularly assigned lecture periods.

731. Thesis.

Course 2, IV Year; 7 hrs. per week, both terms.

The thesis in this Course consists mainly of reports on original work done in the laboratories. In the Third Year the subject "Introductory Research" paves the way for the thesis. By October 15th the student decides on the subject of his thesis, in consultation with his professors. After this is decided the student uses his own initiative in the development of his work.

The thesis is divided into three parts. The first part, which is handed in not later than October 15th, contains the title, a statement of what the title is meant to convey, and an outline of the work proposed to be done. The second part is handed in during the first week of January, and contains a report of progress to date; it also enables the professor in charge to keep in closer touch with the work. The third and final part is handed in two weeks before the beginning of examinations, and is a report of progress to date with final conclusions. The three parts combined constitute the thesis. There will also be required such additional written reports as may be deemed necessary by the Department.

732. Thesis.

Course 3, IV Year.

Printed instructions regarding thesis requirements are issued to each student by the Department of Mechanical Engineering, giving full particulars.

733. Thesis.

Course 5, IV Year.

Each student in the Fouth Year will be required to prepare a thesis on a subject approved by the Committee Administering the Course in Engineering Physics.

734. Thesis.

Course 6, IV Year.

In this subject, to which about one-third of the time of the year is devoted, each student is assigned a research problem by a member of the staff, under whose direction he carries out the necessary laboratory work. This involves a search of the chemical literature respecting the problem, and devising experimental procedures. At the end of the session a thesis is written embodying the results of his search of the original literature and his own experimental work.

This is intended to require the student, on an individual basis, to apply the knowledge gained in his previous courses, and to encourage the development of initiative. Also, for those students who go on to the Graduate School or into industrial research, it is intended as a preliminary training.

In those cases where in the opinion of the staff it would be advantageous for the student to do his research work in a closely allied field, such as electrochemistry, metallurgy, applied physics, etc., the Department will make the necessary arrangements, where possible, with the other Departments concerned.

735. Thesis.

Course 7, IV Year.

Each student is required to prepare a thesis on a subject approved by the Head of the Department of Electrical Engineering. Instructions regarding the form of the thesis will be given to the students at the end of the Third Year.

736. Thesis.

Course 8, IV Year.

Each student in the Fourth Year must prepare a thesis on a subject and in a form approved by the Head of the Department of Metallurgical Engineering.

The most usual type of thesis is on the result of extended search and reading in a specialized field of metallurgical theory or practice.

737. Thesis.

Course 8a, IV Year.

A written report of approximately 6000 words, on a subject approved by the Department. Material for this report is obtained from laboratory and library work, which is carried out under the supervision of a member of the staff.

738. Thesis.

Course 9, IV Year; 6 hrs. per week, both terms.

A report on an investigation made by the student. It is intended to test his ability to make an independent field or laboratory study of some geological problem. The problem chosen must be approved by the Committee Administering the Course in Mining Geology, and plans for the thesis completed not later than November 1st of the student's Fourth Year.

739. Thesis.

Course 10, IV Year.

Each student of the Fourth Year must prepare a written thesis on an approved subject of a length not less than 6000 words. This thesis is to be finished and submitted for binding on the first day of the second term.

740. Thesis.

Course 11, IV Year.

Each student in the Fouth Year, Course 11, is required to prepare and present, in both oral and written form, a thesis on an approved subject in the field of management. Instructions regarding the form of the thesis and the selection of subject are given toward the end of the Third Year.

SECTION X. EXAMINATIONS

ANNUAL EXAMINATIONS

1. Annual examinations will be held in April except as provided in paragraph 2 below.

2. Annual examinations will be held at the beginning of the second term in all subjects completed during the first term.

3. Promotions from one year to another are made on the results of term work and the annual examinations. A student proceeding to a degree must pass in all term work and examinations in all subjects of his course, and at the periods arranged by the Council.

4. The pass marks required on written examinations and laboratory work of all departments are 50 per cent, with an average of 55 per cent on written examinations and an average of 55 per cent on laboratory work. Candidates who have attained the required average and who have failed in not more than two subjects will be required to pass supplemental examinations in those subjects to secure pass standing.

5. Honours will be granted a student who, at the Annual Examinations, passes in all written and laboratory subjects, and who also obtains 75 per cent of the total number of marks allotted to the subjects in his course.

6. Honour graduate standing will be granted to those who obtain honours in the final year and in one previous year.

7. Candidates who fail to secure promotion in the First and Second Years will not be allowed to repeat the work of the year until at least one academic year has elapsed.

8. A student who fails in the work of any year may petition the Council to be allowed to repeat the work of the year. If the petition is granted, registration will be provisional only and will be so endorsed on his registration card.

9. A student will not be allowed to repeat the work of more than one year in his entire undergraduate course.

10. A student who, in either term of the session, fails to perform satisfactorily the work of his course may not be allowed to present himself at the final examinations of the year.

11. A student should submit to Council immediately after its occurrence, evidence of any illness or mishap which occurs during the session; any petition for leniency on account of such incidents may be refused consideration if received after the third day following the last day of examinations.

12. A student who has failed to complete satisfactorily the course in Physical Training prescribed for the First Year will not be permitted to register in the Third Year; and a student who has failed to complete satisfactorily the course in Physical Training prescribed for the Second Year will not be permitted to register in the Fourth Year.

13. A student will not be allowed to write any examinations if he has not paid all fees and dues for which he is liable at that time.

SUPPLEMENTAL EXAMINATIONS

1. The supplemental written examinations will begin on the 8th day of September, 1947. Application (on the prescribed form) to take such examinations, including practical ones, must be received from the candidate by the Secretary of the Faculty not later than July 15th, and the fee named in Sec. VI, para. 11, received by the Chief Accountant not later than September 1st. Council reserves the right to reject applications of, or impose penalties upon, those failing to comply with these requirements. Arrangements will be made to to conduct supplemental examinations at the Survey Camp for those students in attendance at the Camp.

2. If a candidate desires to write upon an annual examination as a supplemental, his application must be received by the Secretary and his fee by the Chief Accountant, for the January examinations not later than December 1st and for the April examinations not later than March 1st.

3. Except under very exceptional circumstances, pass standing must be obtained in all written supplementals before entering the next higher year, and in all laboratory supplementals before or during the Session of the next higher year as may be required by the Department concerned.

TERM EXAMINATIONS

Term examinations may be held in any subject and at any time at the discretion of the instructor, or by order of the Council, and the results of such examination may, if the Council so decides, be incorporated with those of the annual examinations in the same subjects.

EX-SERVICE PERSONNEL

The foregoing regulations are applicable to all students of the Faculty. Special problems of students who have served in His Majesty's Armed Forces will be considered individually by the Council.

SECTION XI. SCHOLARSHIPS, AWARDS AND LOANS

Through the generosity of friends of the University, governments and commercial organizations, encouragement has been given to both undergraduate and graduate work in the various branches of engineering studies by establishing the following scholarships, prizes, bursaries, and medals.

Matriculation students are advised to consult the University of Toronto Calendar on Admission Requirements and Scholarships for complete details of awards available to students entering this Faculty.

Where it is necessary to make application for an award it is so stated in the description and particulars are given as to how the application should be made. In all other cases the award is made on the recommendation of the Faculty Council and no application is necessary.

A student will not be allowed to hold more than one scholarship of those marked by an asterisk, or otherwise designated, in any one year. The student obtaining highest standing in his year and a student winning more than one award will be so shown in the published results. The Council may, at its discretion, award unallocated scholarships to the next eligible candidate.

Name	Amount	Application required	Available only to a limited group or single course	See page
AVAILABLE TO STUDENTS ENTERING THE FIRST YEAR				
Applied Science Bursaries	$1750	Yes	No	162
Emerson Wickett Memorial Scholarship..............	$100	Yes	No	162
Hagarty Memorial Scholarship.	$60	Yes	Yes	162
U.T.S. Engineering Scholarship.	$250	Yes	Yes	163
The Leonard Foundation Scholarships.............		Yes	Yes	163
The Robert Simpson Company Scholarship..............	$100	Yes	Yes	163
O.H.A. War Memorial Scholarship.....................	$200	Yes	Yes	164
Engineering Alumni Admission Scholarship................	$300	Yes	No	164
Students' Administrative Council Admission Scholarship.......	$350	Yes	Yes	165
Ontario-Minnesota Pulp and Paper Co. Ltd. Bursaries....	$500	Yes	Yes	165

Name	Amount	Application required	Available only to a group or single course	See page
AVAILABLE TO STUDENTS COMPLETING THE FIRST YEAR				
University Alumni Federation War Memorial Scholarships	$200	Yes	No	166
*Baptie Scholarship	$100	No	Yes	166
MacLennan-MacLeod Memorial Prize	$25	No	No	166
*Ransom Scholarship in Chemical Engineering	$150	No	Yes	167
T. H. Bickle Bursary	$30	No	Yes	167
*John M. Empey Scholarship	$100	No	No	167
Garnet W. McKee-Lachlan Gilchrist Scholarship in Engineering Physics	$60	No	Yes	168
*Wallberg Undergraduate Scholarships	$600	No	No	168
Hugh Gall Award	$100	Yes	No	168
Carl Swan Award	$80	No	No	168
University Naval Training Division Bursaries	$100	Yes	Yes	169
S. Ubakata Fund		Yes	Yes	169
AVAILABLE TO STUDENTS COMPLETING THE SECOND YEAR				
Rhodes Scholarship	£400	Yes	No	176
University Alumni Federation War Memorial Scholarships	$200	Yes	No	166
*Harvey Aggett Memorial Scholarship	$75	No	No	169
Ontario Association of Architects Scholarship	$100	No	Yes	170
J. A. Findlay Scholarship		No	Yes	170
*Association of Professional Engineers of the Province of Ontario Scholarships	$175	No	Yes	170
T. H. Bickle Bursary	$30	No	Yes	167
Women's Mining Association Scholarship	$150	Yes	Yes	170

Name	Amount	Application required	Available only to a limited group or single course	See page
*Garnet W. McKee-Lachlan Gilchrist Geophysics Scholarships		No	Yes	171
*John M. Empey Scholarship	$100	No	No	167
W. G. Millar Memorial Scholarship	$250	Yes	Yes	172
*Wallberg Undergraduate Scholarships	$300	No	No	168
Ardagh Prize	$50	No	Yes	172
AVAILABLE TO STUDENTS COMPLETING THE THIRD YEAR				
Rhodes Scholarship	£400	Yes	No	176
*Boiler Inspection and Insurance Company Scholarship	$150	No	Yes	172
University Alumni Federation War Memorial Scholarships	$250	Yes	No	165
*Jenkins Scholarship in Engineering	$200	No	No	173
Heating and Ventilating Engineers Prize	$25	No	No	173
E.I.C. Prize	$25	No	Yes	173
Engineering Society Semi-Centennial Award	$75	No	No	173
J. A. Findlay Scholarship		No	Yes	170
*Association of Professional Engineers of the Province of Ontario Scholarships	$225	No	Yes	170
T. H. Bickle Bursary	$30	No	Yes	167
Women's Mining Association Bursary	$150	Yes	Yes	170
Archie B. Crealock Memorial Prize	$25	No	Yes	173
*John M. Empey Scholarship	$100	No	No	167
Hudson Bay Mining and Smelting Company Limited Scholarships	$300	Yes	Yes	174
*Wallberg Undergraduate Scholarships	$300	No	No	168
Toronto Brick Company Prizes	$100	No	Yes	174
AVAILABLE TO STUDENTS COMPLETING THE FOURTH YEAR				
B.A.A.S. Medal		No	No	174

Name	Amount	Application required	Available only to a limited group or single course	See page
Heating and Ventilating Engineers Prize	$25	No	No	173
INCO. Scholarship	$500	Yes	Yes	174
Hobbs Glass Limited Scholarship	$250	No	Yes	175
"Second Mile Engineer" Award	$100	No	Yes	175
AVAILABLE TO STUDENTS COMPLETING THE FIFTH YEAR				
Toronto Architectural Guild Medal		No	Yes	175
Anaconda American Brass Limited Prizes	$300	No	Yes	175
R.A.I.C. Medal		No	Yes	176
AVAILABLE TO GRADUATES				
Rhodes Scholarship	£400	Yes	No	176
1851 Exhibition Science Research Scholarships	£275	Yes	Yes	177
McCharles Prize	$1000	No	No	178
Nipissing Mining Research Fellowships	$1100	Yes	No	178
H. W. Price Research Fellowship on Electrical Engineering		Yes	Yes	178
C.I.L. Fellowship in Chemistry	$750	Yes	No	179
T. A. Russell Memorial Research Fellowship	$1000	Yes	Yes	179
Consolidated Mining and Smelting Company Fellowship	$750	Yes	No	179
Canadian Institute of Steel Construction Research Fellowship	$1200	Yes	No	179
Canadian Lumbermen's Association Timber Research Fellowship	$1000	Yes	No	180
Imperial Oil Graduate Research Fellowships	$4000	Yes	Yes	180
George T. Goulstone Fellowship in Architecture		Yes	Yes	180
Wallberg Research Fellowships	$3000	Yes	No	181
Spruce Falls Power and Paper Company Limited Fellowships	$750	Yes	No	181

NOTE—On account of the continued tendency towards lower rates of interest it is possible that the value of certain scholarships or prizes at the time of payment may prove to be less than the amount stated in the calendar.

APPLIED SCIENCE BURSARIES

To assist promising students in the secondary schools who would otherwise be prevented for financial reasons from entering the Faculty of Applied Science, the Board of Governors has allocated $2000 to assist such persons to commence work at the University. A number of Bursaries, each amounting to approximately $150, will be awarded in 1947 to those applicants who are considered by the Council of the Faculty to be most eligible. An applicant must have obtained First Class Honours in Mathematics and a high proficiency record in the remaining subjects at the Grade XIII examinations for the Province of Ontario, or their equivalent.

Each applicant must apply by letter, giving full particulars of his case, to the Secretary of the Faculty of Applied Science and Engineering not later than September 1, 1947. This application must be accompanied by a letter of recommendation from the principal of the secondary school where his standing was obtained, and if possible a second letter of recommendation from a graduate in engineering, preferably of the University of Toronto, who resides or practises in the vicinity. Application for admission to the University, accompanied by matriculation certificates, must also be submitted to the Registrar of the University at the same time that application for the Bursary is submitted to the Secretary of the Faculty. Some members of the engineering profession have agreed to act as counsellors to prospective students, and the name of one or more of these men residing in the neighbourhood of the applicant may be obtained on application to the Secretary of the Faculty.

THE EMERSON WICKETT MEMORIAL SCHOLARSHIP

The Emerson Wickett Memorial Scholarship, the gift of Mrs. Maude Wickett Kilbourn, in memory of her brother, the late William Emerson Wickett, a graduate of the Faculty of Applied Science and Engineering in 1906, of the value of $100, is awarded to the candidate who, at one examination, obtains standing with the highest average percentage in the subjects of Grade XIII prescribed for admission to the Faculty. An award will not be made in any year in which no candidate obtains an average of at least seventy-five per cent. Application should be made to the Registrar of the University.

THE REGINALD AND GALER HAGARTY SCHOLARSHIP

The Reginald and Galer Hagarty Scholarship, in memory of the dearly beloved sons of Lieutenant-Colonel E. W. Hagarty, B.A. 1883, M.A. 1908, and Charlotte Ellen Hagarty, his wife. Reginald Edward Walter Hagarty, B.A.Sc. (Honours) 1908, a graduate of the University in the Faculty of Applied Science and Engineering and at the time of his death on April 29, 1925, a Consulting Structural Engineer. Lieutenant Daniel Galer Hagarty, Princess Patricia's Canadian Light Infantry, a member of the class of 1916 in Applied Science, enlisted for the Great War at the end of

his third year in June, 1915, killed in action in Sanctuary Wood, June 2, 1916. The scholarship is given in recognition of the fact that their father was an honour graduate in Classics of the University of Toronto. It is of the value of the interest on $2,000 and is to be awarded to a pupil of Harbord Collegiate Institute, Toronto, who at the Grade XIII examinations in the subjects of English, French, Latin and Mathematics stands highest among the students of that school who (*a*) register in the Faculty of Applied Science and Engineering, (*b*) sign a declaration to the effect that they are willing to take up arms in defence of Canada and the British Empire should necessity arise as declared by the Parliament of Canada and (*c*) obtain at least a pass mark in each of the said subjects. The scholarship was offered for award for the first time in 1945. Application should be made to the Registrar of the University.

THE U.T.S. ENGINEERING SCHOLARSHIP

The U.T.S. Engineering Scholarship, the gift of R. A. Bryce, Esq., of the value of $250. The scholarship will be awarded by a committee of the Staff of the University of Toronto Schools to a student of the Schools who has completed the requirements for admission to and enrols in the Faculty of Applied Science and Engineering.

THE LEONARD FOUNDATION SCHOLARSHIPS

Leonard Foundation Scholarships are awarded each year to selected students in Universities and Colleges across Canada, including the University of Toronto. The Trust Deed States: "Preference in the selection of students for scholarships shall be given to the sons and daughters respectively of the following classes: (*a*) clergymen, (*b*) school teachers, (*c*) officers, non-commissioned officers and men, whether active or retired, who have served in His Majesty's military, naval or air forces, (*d*) graduates of the Royal Military College of Canada, (*e*) members of the Engineering Institute of Canada, (*f*) members of the Mining and Metallurgical Institute of Canada."

Further information regarding the procedure to be followed in applying for these scholarships may be obtained by writing to Dr. W. E. Taylor, Honorary Secretary, The Leonard Foundation, c/o Toronto General Trusts Corporation, 253 Bay Street, Toronto.

THE ROBERT SIMPSON COMPANY LIMITED SCHOLARSHIPS

These scholarships, the gift of the Robert Simpson Company Limited, are open only to students of the Copper Cliff High School, The Sudbury High and Technical Schools, the Sturgeon Falls High School, the North Bay Collegiate Institute and Vocational School and all the Secondary Schools along the Ontario Northland Railway. A scholarship of the value of $100 is available for each of the schools mentioned and an additional sum of $50 will be given to the student who obtains

the highest percentage on the nine papers of Grade XIII selected in accordance with the regulations.

No scholarship will be awarded unless the candidate is in actual attendance in one of the colleges or faculties of the University and maintains a uniformly high standard to the satisfaction of the donors of the scholarships.

Applications for these scholarships must be sent not later than May 15th, to the Principal of the North Bay Collegiate Institute, from whom further information may be obtained regarding the conditions of award.

The Ontario Hockey Association War Memorial Scholarship

The Ontario Hockey Association War Memorial Scholarship, the gift of the Ontario Hockey Association, is to be awarded annually at the Grade XIII examination to a man student who has served overseas with the Canadian forces in the Great War of 1914-1918, or to a student who is the son or daughter of one who has so served.

The value of this scholarship is $100 in cash, with an allowance of the same amount on the tuition fee for each session.

In determining the award of the scholarship, the academic qualifications of the candidates shall be first taken into account, provided always that no candidate shall be eligible for an award who has not met all the conditions required by the University of candidates for admission scholarships generally; but, *cæteris paribus*, the award shall be made to a student who is in proved need of assistance.

The award shall be made by the Senate of the University upon the report of a committee to be appointed by the Senate, upon which committee there shall be always one member of the Staff of the University who shall be deemed to be the representative of the Association.

Candidates shall make application not later than May 1st on the special form to be obtained from the Registrar of the University.

ENGINEERING ALUMNI ADMISSION SCHOLARSHIP

The Engineering Alumni Admission Scholarship, the gift of the Engineering Alumni Association, of the value of $300, is awarded on the recommendation of the Council of the Faculty to the candidate who obtains the highest average percentage in the subjects of Grade XIII prescribed for admission to the Faculty of Applied Science and Engineering; applicants are required to write the Problems paper for Scholarship candidates, but the standing on this paper will be used only as auxiliary information. In order to qualify for the scholarship a candidate must at one Scholarship examination obtain an average of at least seventy-five per cent. in the subjects of Grade XIII prescribed for admission to the Faculty and must register in the Faculty of Applied Science and Engineering. The scholarship will not be awarded to a student who has spent more than one year in Grade XIII or more than five years in a Secondary School

or its equivalent unless he can show evidence satisfactory to the Council that his attendance has been extended beyond the period specified for reasons beyond his control. This scholarship is not tenable with any other Admission scholarship.

STUDENTS' ADMINISTRATIVE COUNCIL ADMISSION SCHOLARSHIP

The Students' Administrative Council Admission Scholarship of the annual value of $300, the gift to a student who (*a*) resides within the District of Manitoulin, or within that part of the Province of Ontario which lies north of the forty-sixth parallel of latitude excluding the cities of North Bay, Sudbury, Sault Ste. Marie, Port Arthur and Fort William; (*b*) obtains the highest average standing in first class honours in the nine papers of Grade XIII prescribed for admission to the course which he desires to enter: and (*c*) who enrols in one of the following faculties: Medicine, Applied Science and Engineering, Forestry, Dentistry.

The scholarship is tenable for two years provided that the holder obtains an average of at least sixty-six per cent, at the annual examinations of the First Year. Application must be made to the University Registrar not later than May 1st.

ONTARIO-MINNESOTA PULP AND PAPER COMPANY LIMITED BURSARIES

The Ontario-Minnesota Pulp and Paper Company Limited Bursaries, two in number, each of the value of $500 a year for four years for students who enrol in the Faculty of Arts in the honour courses of Chemistry, Physics and Chemistry (Chemistry option) or Commerce and Finance, or in the Faculties of Applied Science and Engineering or Forestry. They will be awarded one to a student who has completed the University admission requirements at Kenora High School after at least two years' attendance at that school, and the other to a student who has completed the University admission requirements at Fort Frances High School after at least two years' attendance at that school. The decision of the Committee of Award which consists of the President and the Deans of the Faculties of Arts, Applied Science and Engineering, and Forestry will be based primarily on the marks obtained at the Grade XIII examination, but consideration will be given also to physical fitness and financial requirements. In order to retain a bursary from session to session the student to whom one is awarded must, in the opinion of the Committee of Award have a satisfactory record as regards the general character of his work throughout the session, including attendance, laboratory and field work, if any, reports or essays, and term examinations, and must obtain standing in his year. His behaviour while attending the University must be above criticism. Application must be made to the Registrar not later than May 1st.

UNIVERSITY ALUMNI FEDERATION WAR MEMORIAL SCHOLARSHIPS

Eight scholarships, each of a value of $200, will be awarded in 1947-48 by the Alumni Federation from the War Memorial Scholarship Fund to students registered in the Faculty of Applied Science and Engineering.

The general basis on which scholarships may be awarded shall be as follows: (*a*) Standing in course of studies. (*b*) Relationship to active service in the Armed Forces of Canada. (*c*) Need of financial assistance. (*d*) Merit shown by participation and interest in extra-curricular undergraduate activities of the University. (*e*) Such other general qualifications as may commend themselves to the committee recommending the awards.

Information regarding these scholarships may be obtained from the Secretary-Treasurer of the Alumni Federation, 43 St. George St., to whom application for the same must be made in person before April 15th.

BAPTIE SCHOLARSHIP

The Baptie Scholarship is derived from a bequest under the will of the late Mrs. Margaret W. Baptie, of Ottawa, and the Board of Governors has directed that from the income a scholarship of One Hundred Dollars shall be awarded annually to an engineering student on the record of the First Year. The Board of Governors also authorizes a remission of fees in the case of the holder of the scholarship, up to Seventy-five Dollars.

The conditions of the award are as follows: That the scholarship be awarded to the student who, in the annual examinations of the First Year, enrolled in any one of the courses of Civil Engineering, Mining Engineering, Mechanical Engineering, Chemical Engineering, Electrical Engineering, or Metallurgical Engineering, obtains the highest aggregate percentage of marks in those subjects which are common to the First Year curricula of those courses. The first award was made on the results of the annual examinations of the Session 1925-26.

MACLENNAN-MACLEOD MEMORIAL PRIZE

The Graduating Class of 1910 has donated an annual prize to the value of Twenty-five Dollars, known as "The MacLennan-MacLeod Memorial Prize", in memory of their first Class President, George MacLennan, who was killed in action in France in 1917, and of Doug. MacLeod, their first Secretary, who died in France in 1916 from wounds received in action.

The prize is awarded to the First Year student in the Faculty of Applied Science and Engineering who ranks highest in Calculus among those who obtain standing without condition at the annual written examinations; or, in the event of more than one student obtaining equally high rank in Calculus, the award is made to the one of these who also has the highest standing in some other subject common to the competitors, such as Analytical Geometry, such subject to be determined by the Council of the Faculty.

An award will not be made in any year in which, in the opinion of the Council, no student obtains a sufficiently high standing in Calculus to merit the award. In any year in which no award is made, the income from the prize of that year will be available for a second award in any subsequent year.

RANSOM SCHOLARSHIP IN CHEMICAL ENGINEERING

The Ransom Scholarship in Chemical Engineering is presented by A. C. Ransom, Esq., of Toronto, for the purpose of encouraging and giving financial assistance to students who choose the field of Chemical Engineering. This donation, consisting of $5,000, provides for a perpetual scholarship of an annual amount such as will be derived from the income of this sum. The first award was made on the results of the annual examinations of 1938.

The scholarship will be awarded annually to the student registered in the Course in Chemical Engineering who obtains the highest aggregate percentage of marks in the examinations of the First Year. The scholarship will be paid to the winner only if he proceeds to take his Second Year in the Course in Chemical Engineering in the University of Toronto.

THE T. H. BICKLE BURSARY

The T. H. Bickle Bursary is the gift of Mr. and Mrs. E. W. Bickle in memory of their son, T. H. Bickle, an undergraduate of Trinity College and a member of the Senior Intercollegiate Swimming Team at the time of his death in 1937. The income from the endowment of $1,000 will be awarded annually to a member of the Senior Intercollegiate Swimming Team of this University in any year or faculty. The Committee of Award shall consist of the Dean of the Faculty of Arts, the University Registrar, the Director of Athletics, and the Honorary Coach of Swimming. In awarding the Bursary the Committee shall consider the character, scholarship, and general interests of the members of the team.

THE JOHN M. EMPEY SCHOLARSHIPS

The John M. Empey Scholarship Fund was established under a bequest of $10,000 in the Will of the late John Morgan Empey, B.A.Sc., 1903. Three scholarships of equal value are provided from the income from the Fund. One of these scholarships is awarded in each of the First, Second, and Third Years on the results of the annual examinations, to a student who, taking honours, obtains the highest average percentage of marks in the written and laboratory subjects of his Year. The scholarships are open to any students registered in the Faculty. In case the winner of any one of these scholarships does not attend this Faculty during the session next following the award, the right to the scholarship shall be forfeited and the award shall be made to another eligible student. The scholarships were awarded for the first time in 1944.

THE GARNET W. MCKEE-LACHLAN GILCHRIST SCHOLARSHIP IN ENGINEERING PHYSICS

Mrs. Garnet W. McKee and Professor Lachlan Gilchrist each contributed $1000.00 to provide for a Scholarship in the First Year of the Course in Engineering Physics. The value of the Scholarship is the annual income from the capital fund and is awarded to the student who ranks first in honours at the annual examinations of the First Year in the Course in Engineering Physics. If for any reason that student is ineligible to hold the Scholarship, it will be awarded by reversion to the student ranking second in honours in the Course. In order to receive payment the winner must register in the Second Year of the Course in Engineering Physics. The Scholarship was awarded for the first time on the results of the annual examinations of 1947.

WALLBERG UNDERGRADUATE SCHOLARSHIPS

These scholarships, four in number, of the value of $300.00 each, derived from the Wallberg Bequest, are awarded annually; two to students ranking first and second respectively at the annual examinations of the First Year; one to the student ranking first at the annual examinations of the Second Year; and one to the student ranking first at the annual examinations of the Third Year.

Any holder of one of these scholarships may not hold other awards isted in the Calendar with an asterisk. The awards were first made on the results of the annual examinations of 1947.

HUGH GALL AWARD

The Hugh Gall Award, of the value of One Hundred Dollars, the gift of the Graduate Class of 1910, "to commemorate a deceased classmate who was a splendid type of student, a loyal friend, and nationally outstanding in athletic achievement during his undergraduate career", was established in 1946. It is awarded to a student, who, having completed his First Year with a general average of at least 66% without conditions, has entered the Second Year, and is in special need of financial assistance in order to enable him to continue his course. It is desirable, but not necessary, that the recipient shall not already have been given any other scholastic award or scholarship applicable to the Second Year and he shall have shown indications of his firm intention and ability to follow successfully the profession of engineering.

Any second year student in the Faculty of Applied Science and Engineering is eligible to apply for this Bursary. Applications should be made to the Secretary of the Faculty not later than one month after the opening of the session.

CARL SWAN AWARD

The Carl Swan Award, the gift of the Reverend Carl Swan, Chaplain of the Ajax Division, of the value of $80.00, is awarded annually to the

First Year student of the Ajax Division, who is adjudged to have made the most outstanding and the most consistent contribution to the life of the campus in the social, athletic and cultural fields, and whose academic standing commends itself to the Selection Committee.

The first award was made for the Session 1946-47.

UNIVERSITY NAVAL TRAINING DIVISION BURSARIES

The University Naval Training Division Bursaries, the gift of the University Naval Training Division, are of the value of $100. each. As many as three bursaries may be awarded in each session; if fewer than three are awarded those not awarded may be given in a subsequent session, A candidate must be registered in the University for a full-time course leading to a diploma or degree and must be at the time of the award a member of one of the recognized military training units within the University. Application must be made to the University Registrar before the end of November.

S. UBAKATA FUND

The S. Ubakata Fund for Japanese Students, the gift of the late S. Ubakata, provides for the establishment of scholarships, bursaries, medals, prizes, and loans for students from Japan proper attending the University of Toronto or one of its federated or affiliated colleges. An applicant for a scholarship, bursary or loan must be in good standing and have completed the first year of the work of the faculty or department in which he is registered. An occasional student must obtain a certificate from the head of the college or dean of the faculty concerned that full time is being devoted to his or her studies. A student is not eligible who is at the time in receipt of aid or support from any other institution, religious or otherwise, in this country or in Japan or who already holds a scholarship or fellowship in the University. Application must be made to the University Registrar on or before December 1st.

HARVEY AGGETT MEMORIAL SCHOLARSHIP

This scholarship was donated by the late Mr. J. T. Aggett, of Toronto, as a perpetual memorial to his son, the late Lieutenant Harvey Aggett, who enlisted in March, 1915, during his second year in this Faculty, and was killed in action at Passchendaele on 6th November, 1917.

This annual scholarship of the value of the annual income from the fund is to be awarded to a student of the Second Year in this Faculty who, obtaining honours and being one of the first three in his year by his standing at the annual examinations, has been adjudged highest of the three in general student activities and service in the University during his period of attendance. When regulations do not permit the winner to hold this scholarship the students to be considered for the award shall be the first three in the year exclusive of any student who holds a scholarship of higher value.

ONTARIO ASSOCIATION OF ARCHITECTS SCHOLARSHIP

The Ontario Association of Architects offers a scholarship of One Hundred Dollars to the student of the Second Year in the School of Architecture who, at the annual examinations, obtains the highest honour standing in Architectural Design. The scholarship was awarded annually from 1928 to 1945 inclusive and has been extended for a further period of five years.

J. A. FINDLAY SCHOLARSHIPS

These scholarships were established through a legacy bequeathed by the late Miss Janet Findlay to the Department of Mechanical Engineering. Two scholarships are available to students in this Course, one for a student in the Third Year, the other for a student in the Fourth Year, but only if the student continues his course in Mechanical Engineering. The selection will be made, on recommendation of the Head of the Department of Mechanical Engineering, from amongst the four students having the highest average percentage of marks at the annual examinations in the Second and Third Years respectively, but in making the award the student's general character, fitness for his profession, and financial circumstances will be given consideration. In case a student who has been awarded one of the scholarships changes his course or does not attend this University during the next following session, he shall forfeit his right to the scholarship and the award shall be made to another eligible student.

ASSOCIATION OF PROFESSIONAL ENGINEERS OF THE PROVINCE OF ONTARIO SCHOLARSHIPS

The Association of Professional Engineers of the Province of Ontario offers the following scholarships to students registered in any course of the Faculty of Applied Science and Engineering (except Architecture):—

(*a*) Scholarships of One Hundred Dollars and Seventy-five Dollars, respectively, to the two students in the Second Year who, taking honours, obtain the highest per cent of the total number of marks allotted to the subjects of their respective courses.

(*b*) Scholarships of One Hundred Dollars, Seventy-five Dollars and Fifty Dollars, respectively, to the three students in the Third Year who, taking honours, obtain the highest per cent of the total number of marks in their respective courses.

These scholarships will not be awarded to students who hold other scholarships.

THE WOMEN'S MINING ASSOCIATION BURSARY

The Women's Mining Association has presented a Bursary having the value of One Hundred and Fifty Dollars annually, commencing 1939. The Bursary is awarded to a student entering the Third or Fourth Year in the Course in Mining Engineering, Metallurgical Engineering, or

Mining Geology; it may be awarded two years in succession to the same student, but will usually be awarded at the beginning of the Third Year. The award will be made by a special committee appointed by the Association on the following basis:

(*a*) In addition to mental capacity, the student must show leadership ability and give promise, through his activities, of becoming a worthwhile influence in the affairs of the profession and the community.

(*b*) While attention is given to scholastic ability, as evidenced by his academic standing, it is not the governing factor. He must, however, stand in the top quarter of his class.

(*c*) Special consideration is given to financial need.

Application must be made to the Secretary of the Faculty within one month of the opening of the academic year.

THE GARNET W. MCKEE-LACHLAN GILCHRIST GEOPHYSICS SCHOLARSHIPS

Financial assistance was received by Professor Lachlan Gilchrist of the Departments of Physics, University of Toronto, from certain organizations and individuals to help him in the prosecution of his research work in Geophysics. With the consent of the contributors, the unexpended balance of these gifts was transferred by Professor Gilchrist to the Board of Governors of the University to be used as an endowment for scholarships, two of which were established in the Faculty of Applied Science and Engineering. To this fund have been added additional amounts received from the estate of the late Garnet W. McKee and from the Hollinger Consolidated Gold Mines Ltd. They are awarded by the Senate, on the recommendation of the Council of the Faculty of Applied Science and Engineering. The first awards were made on the results of the Annual Examinations of 1941.

The First Garnet W. McKee-Lachlan Gilchrist Geophysics Scholarship. This scholarship, of the annual value of the income from $4,000.00, is awarded to the student in the Second Year in the Course in Engineering Physics who obtains the highest aggregate standing at the examinations of the First and Second Years in the Course, provided always that the student obtains honour standing at the examinations of the Second Year.

The Second Garnet W. McKee-Lachlan Gilchrist Geophysics Scholarship. This scholarship, of the annual value of the income from $3,000.00, is awarded to the student in the Second Year in the Course in Engineering Physics who, of those students who elect to proceed in the Third Year in the Geophysics Option of the Course, obtains the highest aggregate standing at the examinations of the First and Second Years, provided always that the student obtains honour standing at the examinations of the Second Year, and excluding always the student to whom the First Lachlan Gilchrist Geophysics Scholarship has been awarded.

If in any year there is no student who has fulfilled the conditions as laid down for the Second Lachlan Gilchrist Geophysics Scholarship, it shall

be awarded to the student in the Second Year in the Course in Engineering Physics who obtains the second highest aggregate standing at the examinations of the First and Second Years of that Course, provided always that such student obtains honour standing in the examinations of the Second Year.

THE W. G. MILLAR MEMORIAL SCHOLARSHIP

The W. G. Millar Memorial Scholarship is presented by Irish and Maulson, Limited, of an annual value of $250.00, in memory of the late Mr. W. G. Millar, a member of the Class of 1914 in Civil Engineering. The Scholarship will be awarded to a student entering the Third Year in Mining Engineering, on the recommendation of the Head of the Department of Mining Engineering.

The award will be made on the following basis:

(a) In addition to mental capacity, the student must show leadership ability and give promise, through his activities, of becoming a worthwhile influence in the affairs of the profession and the community.

(b) While attention is given to scholastic ability, as evidenced by his acedamic standing, it is not the governing factor. He must, however, stand in the top quarter of his class.

(c) Special consideration is given to financial need.

Application must be made to the Secretary of the Faculty within one month of the opening of the academic year.

ARDAGH PRIZE

The Ardagh Prize, of the annual value of Fifty Dollars, has been provided in memory of his parents by Professor E. G. R. Ardagh, B.A.Sc., F.R.S.C., formerly professor of Applied Chemistry in the Faculty. It is awarded to the student who attains the highest standing in Honours at the annual examinations of the Second Year in the Course in Chemical Engineering. The first award was made on the results of the annual examinations of 1946.

Provision has been made for annual increases to the fund from which the prize is derived until the sum of Five Thousand Dollars is reached in 1956, at which time the award becomes the Ardagh Scholarship of the value of the income from the said fund.

BOILER INSPECTION AND INSURANCE COMPANY SCHOLARSHIP

The Boiler Inspection and Insurance Company of Canada offers a scholarship in the Course in Mechanical Engineering of the value of One Hundred and Fifty Dollars to the student who obtains highest honour standing in the regular examinations of the Third Year.

The successful candidate will be expected to proceed to his Fourth Year during the session next following the date of the award.

The amount of the award will be credited by the Bursar to the fees of the Fourth Year of the successful candidate.

JENKINS SCHOLARSHIP

The Jenkins Scholarship, presented by Jenkins Bros., Limited, Montreal, first awarded in 1925, has been donated to continue indefinitely.

This Annual Scholarship, of the value of Two Hundred Dollars, is awarded to the student of the Third Year registered in any course of the Faculty who has the highest aggregate of percentages for the First, Second, and Third Years.

HEATING AND VENTILATING ENGINEERS PRIZE

The Ontario Chapter of the American Society of Heating and Ventilating Engineers offers an annual prize of Twenty-five Dollars, first awarded in 1931, for a period of five years, and extended indefinitely in 1935. The prize will be awarded to a student in either the Third or Fourth Year in any Course of the Faculty who, in the opinion of the Department of Mechanical Engineering, has written the most satisfactory thesis on a subject dealing with heating or ventilation, such thesis being prepared under special arrangements made by the Department of Mechanical Engineering, the result to be reported to the Council with the annual examination results. The thesis must be handed in not later than March 1st. The prize will not necessarily be awarded in any year.

Application should be made to the Department of Mechanical Engineering.

ENGINEERING INSTITUTE OF CANADA PRIZE

The Engineering Institute of Canada, having in view that one of its objects is to facilitate the acquirement and interchange of professional knowledge among its members, offers an annual prize of Twenty-five Dollars in this University, commencing 1931, to the student who, in his Third Year in any one of the six courses of Engineering, has proved himself most deserving as disclosed by the examination results of the year, in combination with his activities in the Engineering Society or with a local branch of another recognized engineering organization.

ENGINEERING SOCIETY SEMI-CENTENNIAL AWARD

The Engineering Society Semi-Centennial Award, to the value of Seventy-five Dollars, was established in 1931 to commemorate the semi-centennial of the founding of the "School". The award is made to a student entering the final year.

The selection is based upon the following qualifications, which bear equal weight in the selection of the winner: (*a*) General "School" activities. (*b*) Contributions to the Engineering Society Executive Committee. (*c*) Personality, and social and athletic activities. (*d*) Academic standing.

ARCHIE B. CREALOCK MEMORIAL PRIZE

The Archie B. Crealock Memorial Prize is the gift of Mrs. Archie B. Crealock, in memory of her husband, an eminent bridge engineer and a

graduate of the Faculty of Applied Science and Engineering of the University of Toronto. It is offered annually to the student of the Third Year in the Course in Civil Engineering, who, having obtained honours in that year, is deemed to be the most worthy of the award. The award is made primarily on the basis of academic standing in the structural subjects of the Year, but extra-curricular activities are also taken into consideration. The Prize consists of engineering books to the value of Twenty-five Dollars. The award will not necessarily be made in any year.

HUDSON BAY MINING AND SMELTING COMPANY LIMITED SCHOLARSHIPS

The Hudson Bay Mining and Smelting Company Limited awards Scholarships to students who have obtained their Senior Matriculation at the High Schools in Flin Flon, Manitoba, and its environs. These Scholarships, having a value of $800.00 each annually, may be held in the Third and Fourth Years in this Faculty, in the Courses in Chemical Engineering, Metallurgical Engineering, Mining Engineering, and Mining Geology. Application should be made to the Company.

TORONTO BRICK COMPANY PRIZES

The Toronto Brick Company offers two prizes, one of Seventy-five Dollars and one of Twenty-five Dollars, to those students of the Third Year in the School of Architecture who win first and second places in a competition arranged by the Staff in the School of Architecture for this purpose.

B.A.A.S. MEDAL

A bronze medal has been donated by members of the British Association for the Advancement of Science, for students of the Faculty of Applied Science and Engineering. This medal will be awarded to the student of the Final Year, in any course, who, taking honours, obtains the highest aggregate percentage in practical and written examinations in the Year.

INCO SCHOLARSHIP

The International Nickel Company of Canada, Limited, offers a scholarship of $500.00, commencing with the Session 1941-42, and from year to year thereafter as the Company may decide, to be awarded to a graduate of the Faculty of Applied Science and Engineering in Chemical Engineering, Metallurgical Engineering, Mining Engineering or Mining Geology, who has taken a consistently high standing in the majority of the subjects of his course, and who is adjudged by the Council of the Faculty to be most suitable to receive the award.

The applicant must proceed to the M.A.Sc. degree in the Session in which he receives the scholarship. Application must be made before May 1, to the Secretary of the School of Graduate Studies, with a statement of the research problem which he proposes to study.

HOBBS GLASS, LIMITED, SCHOLARSHIP

Hobbs Glass, Limited, offers a scholarship annually, commencing with the Session 1945-46, to the student of the Fourth Year in Architecture presenting the best solution to a problem of design set by the staff in Architecture in consulation with the donor. The value of the scholarship is the Fifth Year academic fee.

"SECOND MILE ENGINEER" AWARD

Inspired by an address of President William E. Wickenden of Case School of Applied Science, Cleveland, called "The Second Mile", which was based on the text from the Sermon on the Mount, "whosoever shall compel thee to go one mile, go with him twain", the Class of 1935 has established the "Second Mile Engineer" Award. It is the desire of the donors to encourage students to participate in activities outside the confines of their technical training and to interest themselves in the more liberal subjects of the curriculum. The value of the award is $100.00 and is given to a student in his final year.

An eligible group is chosen from those who have taken a prominent part in the affairs of the Faculty, either as office holders or in athletics. In making the award consideration is given to academic standing, with special emphasis on the candidate's attainments in the cultural and humanistic-social studies. The subjects which are stressed are English, and Engineering and Society of the First Year; Economics of the Second Year; and Political Science, and Modern World History of the Third Year.

Particulars are furnished each session by the Class of 1935.

ANACONDA AMERICAN BRASS LIMITED PRIZES

Anaconda American Brass Limited offers prizes in the School of Architecture for the Session 1947-48, a first prize of $200.00 and a second prize of $100.00 to the two students of the Fifth Year in Architecture, who obtaining honour marks, stand first and second, respectively, in the best solution of a problem in design set by the staff of the School of Architecture in consultation with the Company.

TORONTO ARCHITECTURAL GUILD MEDAL

The Toronto Architectural Guild was the organization of local architects from which sprung the Ontario Association of Architects. When the new and wider association became firmly established, the Guild disbanded and handed over to a trustee board certain funds for the establishment of a medal to be awarded in the School of Architecture of the University of Toronto.

The Trustee Board, now that the fund has accumulated considerably, announces its intention of awarding this medal annually to a senior student showing outstanding ability in Architectural Design.

ROYAL ARCHITECTURAL INSTITUTE OF CANADA MEDAL

The Royal Architectural Institute of Canada has presented a medal to be awarded annually to a member of the graduating class in the School of Architecture who, having completed the requirements for the degree, has obtained high standing throughout his course and gives promise of being an architect of distinction after graduation. The person to whom the award is made must be a British subject; he must have completed the entire course in Architecture in the School of Architecture of the University of Toronto, except in the case of a graduate of the Royal Military College who shall have completed at least the third, Fourth, and Fifth Years in the School; he must have obtained high standing throughout his course, particularly in Architectural Design, and his character, personality, and intellect must be such as to indicate that in the practice of his profession, he may be expected to attain distinction. No award will be made in any Session in which the Council of the Faculty of Applied Science and Engineering so recommends.

THE RHODES SCHOLARSHIP

The Rhodes Trustees offer two scholarships for award annually in the Province of Ontario, each of the basic value of £400 a year but temporarily increased to £500. They are tenable ordinarily for two years at the University of Oxford. A third year is given conditionally at Oxford or elsewhere abroad.
application. "Service" candidates who have had at least one year of war service are not disqualified by marriage and may deduct the war years to bring themselves within the age limits.

In that section of the will in which he defined the general type of scholar he desired, Mr. Rhodes mentioned four groups of qualities, the first two of which he considered most important:

(1) Literary and scholastic attainments;

(2) Qualities of manhood, truth, courage, devotion to duty, sympathy, kindliness, unselfishness, and fellowship;

(3) Exhibition of moral force of character and of instincts to lead and to take an interest in his fellows;

(4) Physical vigour, as shown by fondness for and success in outdoor sports.

Some definite quality of distinction, whether in intellect, character or personality, or in any combination of these, is the most important requirement. Financial need does not receive special consideration.

Forms of application and full information regarding these scholarships may be obtained from the Hon. D. R. Michener, Esq., 5 Rosedale Road, Toronto 5, General Secretary for Canada or from Ralph C. Henson, Esq., Provincial Secretary, Room 12, 25 Melinda Street, Toronto 1, or from the University Registrar. Selection is made in December each year for the

scholarships for the year following. Application must be made to the Provincial Secretary on or before November 10th.

THE 1851 EXHIBITION SCIENCE RESEARCH SCHOLARSHIPS

The Royal Commissioners for the Exhibition of 1851 have invited the University of Toronto to recommend annually one or more candidates in order of merit for science research scholarships, each of the value of £350 per annum and ordinarily tenable for two years. The Commissioners may make a supplementary grant up to £50 per annum for University fees, etc., payable by the scholar during his tenure of the award.

Each candidate recommended must be a British subject, and under twenty-six years of age except in very special circumstances; he must have been a student of science in a university institution for a period of not less than three years and must have spent one full academic year at this University ending not more than twelve months prior to the date of recommendation.

The record of a candidate's work must indicate high promise of capacity for advancing science or its applications by original research. Evidence of this capacity, which is the main qualification for the scholarship, is strictly required. The most suitable evidence is a satisfactory account by the candidate of research work already performed, and the Commissioners will decline to consider the claims of a candidate unless such an account is furnished, or unless there is other equally distinct evidence that he possesses this qualification.

The scholar will be required to devote his whole time to research in some branch of pure or applied science at an institution in the United Kingdom or abroad, selected with the approval of the Commissioners.

The following are the departments of the University, the students of which are eligible to apply for these scholarships: 1. Bacteriology; 2. Biochemistry; 3. Botany; 4. Chemistry; 5. Engineering; (chemical); 6. Engineering (civil); 7. Engineering (electrical); 8. Engineering (mechanical); 9. Engineering (metallurgical); 10. Engineering (mining); 11. Forestry; 12. Geological Sciences; 13. Physics; 14. Physiology; 15. Zoology.

A Student shall not be deemed to be eligible because of his being on the staff of the university, if he has not been in receipt of a salary of more than $800 per annum and the nominating board may, at its discretion, recommend candidates who have been in receipt of larger salaries provided that all other conditions are fulfilled.

A student shall be deemed to be eligible in the year in which he intends to graduate, but if nominated for the scholarship his nomination shall be subject to his being successful in passing his examination for his degree.

The nominating board consists of the following members appointed by the Senate:—the Chancellor, the President, the Provost of Trinity College, Dean Beatty, Dean Hunter, Assistant Dean Ryerson, Dean Young, Dr.

C. S. MacInnes and Mr. N. F. Parkinson, and the Board shall have power to call to its aid as assessor any member of the teaching staff.

Applications for these scholarships must be submitted not later than April 15th to the University Registrar from whom copies may be obtained of the general regulations of the Commissioners governing the award and tenure of the scholarship.

MCCHARLES PRIZE

This prize, the gift of the late Æneas McCharles of the value of $1,000, is awarded from time to time but not necessarily every year on the following terms and conditions: (1) to any Canadian from one end of the country to the other, and whether student or not, who invents or discovers any new and improved process for the treatment of Canadian ores or minerals of any kind, after such process has been proved to be of special merit on a practical scale; (2) or for any important discovery, invention or device by any Canadian that will lessen the dangers and loss of life in connection with the use of electricity in supplying power and light (3) or for any marked public distinction achieved by any Canadian in scientific research in any useful practical line. The following conditions determine the method of award:—

(1) The title shall be the McCharles Prize.

(2) The value of the prize shall be One Thousand Dollars ($1,000.00) in money.

(3) Every candidate for the prize shall be proposed as such in writing by some duly qualified person. A direct application for a prize shall not be considered.

(4) The composition of the awarding body shall be as follows:—

An expert in Mineralogy,
An expert in Electricity,
An expert in Physics,

and four other persons. All of the members of this body shall be nominated by the Board of Governors of the University of Toronto.

NIPISSING MINING COMPANY RESEARCH FELLOWSHIP

The Nipissing Mining Company has endowed a Research Fellowship in the Department of Mining Engineering, to be known as The Nipissing Mining Company Research Fellowship, of the annual value of the income from the fund, plus free tuition.

This Fellowship is open to graduates of any University.

THE H. W. PRICE RESEARCH FELLOWSHIP IN ELECTRICAL ENGINEERING

The H. W. Price Research Fellowship in Electrical Engineering consisting of the income or a part thereof but not exceeding the income for three years derived from the sum of $10,000 donated by the Hydro Electric Power Commission of Ontario, will be awarded from time

to time to a graduate in Electrical Engineering of any recognized University, registered in the School of Graduate Studies, wishing to proceed with an investigation in the field of Electrical Engineering.

Forms of application may be obtained from the Secretary, School of Graduate Studies, and should be returned with a statement of qualifications not later than March 1st. The first award was available in 1943.

THE C.I.L. FELLOWSHIP IN CHEMISTRY

This Fellowship, the gift of Canadian Industries Limited, of the value of $750 is established for the encouragement of post-graduate work in Chemistry. It is open to any British subject who is a graduate of a recognized University. The holder of this Fellowship will be required to undertake research in any branch of Chemistry under the direction of the department designated by the Committee of Award. Application must be made, with full statement of qualifications and testimonials, to the Secretary of the School of Graduate Studies not later than March 1st.

T. A. RUSSELL MEMORIAL RESEARCH FELLOWSHIP

The T. A. Russell Memorial Research Fellowship in Physical Metallurgy, of the maximum value of $1,000, in the Faculty of Applied Science and Engineering will be awarded to a student registered in the School of Graduate Studies who undertakes advanced work in the field of physical metallurgy. Applications must be made to the Secretary, School of Graduate Studies.

CONSOLIDATED MINING AND SMELTING COMPANY OF CANADA, LIMITED, RESEARCH FELLOWSHIP

The Consolidated Mining and Smelting Company of Canada, Limited, offers annually a Research Fellowship in the School of Graduate Studies of $750.00 for a research related to non-ferrous metals, heavy chemicals, and fertilizers. The Fellowship is known as the "Cominco Research Fellowship."

It is open to graduates in Science, Engineering, or Agriculture of a recognized university and preferably a British subject resident in Canada.

Applications for the Fellowship must be made to the Secretary of the School of Graduate Studies, not later than September 1.

CANADIAN INSTITUTE OF STEEL CONSTRUCTION RESEARCH FELLOWSHIP

This fellowship, donated by the Canadian Institute of Steel Construction, is offered to encourage scientific research in steel construction. It is open to honour graduates in engineering of any recognized university. The holder of the fellowship must be registered in the School of Graduate Studies as a student proceeding to a post-graduate degree and must carry out a programme of study and research prescribed by the School of Graduate Studies. The annual value of the fellowship is not less than $750 for a seven months term and not more than $1,200 for a ten months term.

Application should be made to the Secretary of the School of Graduate Studies not later than September 1 and should be accompanied by an official transcript of the applicant's undergraduate record, together with a statement of his engineering experience.

CANADIAN LUMBERMEN'S ASSOCIATION TIMBER RESEARCH FELLOWSHIP

This fellowship, donated by the Canadian Lumbermen's Association, is offered to encourage advanced study and research in timber engineering. It is open to graduates in engineering and graduates in forestry of any recognized university. The fellow must be registered in the School of Graduate Studies as a student proceeding to a post-graduate degree and must carry out a prescribed programme of study and research in both engineering and forestry. It is intended that the work of this programme will extend over a period of two academic years. The annual value of the fellowship is $1,000, all of which might not be granted to one student.

Application should be made to the Secretary of the School of Graduate Studies not later than September 1 and should be accompanied by an official transcript of the applicant's undergraduate record, together with a state- ment of his experience in the forestry and construction fields.

IMPERIAL OIL GRADUATE RESEARCH FELLOWSHIPS

Imperial Oil Limited, in 1946, established for annual competition four research fellowships of the value of $3,000.00 each, ($1,000.00 per year payable in Canadian funds for a maximum of three years), open to graduates of any approved university in Canada. These fellowships are offered for graduate work leading to a Doctor's or Master's degree in the fields of Petroleum Engineering, Petroleum Geology, Chemistry or Chemical Engineering, and Mechanical Engineering. Nomination of students for these fellowships is made by the University—such nominations being submitted to the Imperial Oil Scholarship Committee, Imperial Oil Limited, 56 Church Street, Toronto, not later than June 1st, each year. Nomination forms and information as to the terms of fellowships are available at the University Registrar's office.

THE GEORGE T. GOULSTONE FELLOWSHIP IN ARCHITECTURE

The late George T. Goulstone of New York City bequeathed to the University the sum of $10,000.00, to be known as the Goulstone Foundation, the income therefrom to be paid to such worthy student or students of the University as may be designated from time to time, with the wish that those enjoying such awards devote themselves in the main to the study of Georgian Architecture in England.

In order to carry out this wish, the George T. Goulstone Fellowship in Architecture has been established, open to graduates in Architecture of this University, with a value of the accumulated income from the Goulstone

Foundation or such portion thereof as the Council of the Faculty may recommend.

Application should be made to the Secretary of the Faculty.

WALLBERG RESEARCH FELLOWSHIPS

Two Wallberg Research Fellowships, derived from the Wallberg Bequest, of a value of $1,500.00 each are offered to graduates of a recognized university pursuing advanced study and research in any branch of engineering or in architecture, provided the necessary staff and facilities are available in the field of study or investigation proposed by the applicants. Holders of the fellowships will be required to register in the School of Graduate Studies as candidates for an advanced degree. Awards will be made only if satisfactory applicants are available.

Recommendation of candidates and subjects of research to the School of Graduate Studies will be made by a committee composed of the Dean of the Faculty of Applied Science and Engineering, who will act as chairman, three members of the staff of the Faculty, and three members of the Engineering Alumni Association.

SPRUCE FALLS POWER AND PAPER COMPANY, LIMITED, FELLOWSHIPS

The James Herbert White Fellowship in Forestry, the Robert W. Lyons Fellowship in Forestry, the Cola G. Parker Fellowship in Forestry, the Charles H. Sage Fellowship in Applied Science, the Egerton S. Noble Fellowship in Applied Science, and the Arthur Hayes Sulzberger Fellowship in Applied Science, each the gift of the Spruce Falls Power and Paper Company, Limited, are established for the encouragement of research in the Faculties of Applied Science and Engineering and of Forestry. They are open to graduates of the University of Toronto and of other recognized universities, but are restricted to Canadian citizens.

The value of each Fellowship is up to $750. Application, together with a transcript of his academic record and an outline of the advanced study and research which he proposes to undertake, should be sent to the Secretary of the School of Graduate Studies, not later than September 1st.

LOAN FUNDS

From the loan funds mentioned below, small loans can be made to students who are in urgent need of assistance. The funds are not large and the loans must accordingly be restricted, both in amount and number, and principally to students in the Third and Fourth Years.

Enquiries for loans from any of the following funds should be made at the office of the Secretary of the Faculty:

Engineering Society Loan Fund
Elizabeth Speller Memorial Fund
James W. Crocker Memorial Fund
Harry F. Bennett Educational Fund.

ENGINEERING SOCIETY LOAN FUND

In 1932 the Engineering Society repaid to the Board of Governors a series of annual grants which, over a period of years, had been made to the Society for special purposes. The Board of Governors, appreciating this action, set aside this sum, to be known as the Engineering Society Loan Fund, to provide loans to students of the Faculty of Applied Science and Engineering. The administration of the fund is carried out by a Committee appointed by the Board. The fund is not large, and only small loans can be made to relatively few students. Further inquiries should be made at the office of the Secretary of the Faculty.

ELIZABETH SPELLER MEMORIAL FUND

Through the generosity of Dr. F. N. Speller, of the class of 1893, the "Elizabeth Speller Memorial Fund" has been established, the annual income from which is available for loans to worthy students of the Third and Fourth Years of this Faculty. Applications for loans from this Fund should be made to the Secretary of the Faculty.

JAMES W. CROCKER MEMORIAL LOAN FUND

This fund was established by Mrs. William Crocker in memory of her son, James W. Crocker, a graduate in Mining Engineering in 1938, who was killed in an accident in a mine in the same year.

HARRY F. BENNETT EDUCATIONAL FUND

This fund was established by subscription from members of The Engineering Institute of Canada in memory of the late Harry F. Bennett, M.E.I.C., who for six years prior to his death in 1946 was chairman of the Institute's Committee on the Training and Welfare of the Young Engineer, and who accomplished so much in this field by untiring efforts.

One purpose of the fund is to make loans to deserving students who need financial assistance to enable them to study engineering sciences at university level, and who have proved themselves by successfully completing their first year in engineering or the equivalent.

Loans will be made largely on the basis of character and to men who seem likely to develop the high professional standards which are essential to leadership in engineering science. A student who has been aided by this fund should feel that high obligations are placed on him; obligations to the subscribers, to the trustees, and to those coming after him who in turn can receive help as his loan is repaid.

Application forms may be obtained at the Faculty Office. The regulations are simple and the application of any worth-while student will be given immediate and careful attention.

SECTION XII. LIBRARIES AND LABORATORIES

THE UNIVERSITY LIBRARY

The University Library building is situated on the east side of the lawn that lies to the south of University College. It contains reading-rooms for men and for women, a law reading-room, and a medical reading-room, besides departmental studies which may be used as study rooms for honour students in the various departments in which the professors hold seminary courses, and private studies intended for advanced students engaged in research work.

The University Library building is open from 8.45 a.m. to 10 p.m. during the academic term. In the vacation, it is open from 9 a.m. to 4 p.m. (1 p.m. on Saturdays). Books in ordinary use may not be taken out of the Library building or from the reserved book reading-rooms during the day-time, but are lent for the night after 3 p.m., to be returned the following morning not later than 10 o'clock. Books not in general demand may, on application, be borrowed for a longer period.

AJAX DIVISION LIBRARIES

There are two main libraries at Ajax, the Technical Library and the General or Circulating Library.

The Technical Library is located in the Academic area, close to the lecture rooms and laboratories, and contains the books and periodicals recommended in connection with the courses of instruction. It provides facilities for study during working hours; and books may also be borrowed from it for short periods.

The General or Circulating Library is located in the northern area near the residences. It contains a collection of general reference works, and also a wide variety of both educational and recreational reading. Books may be borrowed without time limit, but subject to recall.

Books not available in Ajax may be borrowed from the University Library in Toronto, either through the Technical Library or through the Circulating Library, provided they are not in urgent demand in the University Library.

DEPARTMENTAL LIBRARIES

Periodicals and other literature in the University Library of special interest to the students of this faculty have been housed in the Electrical. Engineering, Mechanical, and Mining Buildings for convenient reference,

These departmental libraries are situated as follows:

Applied Physics..............	Room 22, Engineering Bldg.
Architecture..................	Room 37, Engineering Bldg.

Chemical Engineering........	Room 53½, Mining Bldg.
Civil Engineering............	Room 25, Electrical Bldg.
	Room 22, Engineering Bldg.
Electrical Engineering........	Room 25, Electrical Bldg.
Geology....................	Room 74½, Mining Bldg.
Mechanical Engineering.......	Room 6, Mechanical Bldg.
Metallurgical Engineering.....	Room 37, Mining Bldg.
Mining Engineering..........	Room 314, Mill Bldg.

CIVIL ENGINEERING LABORATORIES

There are four main divisions comprising these laboratories, namely: Cement, Highway, Soil Mechanics, and Mechanics of Materials.

CEMENT LABORATORY

The Cement laboratory contains all the appliances necessary in making the usual physical tests on Portland cement. It is supplied with cabinets and apparatus for individual work and various shot machines designed for tension and transverse tests. In addition, the laboratory is equipped with moulds, knock-down forms for beams, drying ovens, a curing room controlled for temperature and humidity, and other apparatus required in investigating the properties of aggregates and concrete mixtures.

HIGHWAY LABORATORY

The Highway laboratory is equipped to carry out investigations in bituminous and non-bituminous materials used in highway construction and maintenance. Among the more important pieces of apparatus are the Deval abrasion, the Page Impact, and the Dorry Hardness machines, a standard brick rattler, jaw crusher, diamond core drill with rock saw and grinding lap, bituminous extractor, viscosimeters, ductility and penetration machines, cementation test apparatus, electric ovens, constant temperature baths and special equipment for the determination of the properties of subsoils.

SOIL MECHANICS LABORATORY

The Soil Mechanics laboratory is supplied with apparatus designed for the investigation of the physical properties of soils. It contains a mechanical centrifuge for determining moisture equivalents, Dow liquid limit machines, consolidation and shear machines, Proctor compaction test apparatus, a penetration and bearing power machine, sampling tools, dispersing apparatus, hydrometers, etc., and a device for demonstrating the quicksand phenomena, permeameters.

MECHANICS OF MATERIALS LABORATORY

The Mechanics of Materials laboratory is available for the scientific and commercial testing of materials of construction such as iron, steel, timber, concrete, and masonry. The equipment includes a Riehle

400,000-lb. three screw power universal testing machine, with a capacity for beams and girders up to 28 inches in width and 16 feet in span, and for specimens in tension and compression up to 10 feet in length, a Riehle 200,000-lb. screw power universal testing machine, taking beams 18 feet in span, and tension and compression specimens up to 12 feet in length, a Riehle 100,000-lb. screw power universal testing machine, a Riehle 20,000-lb. screw power universal testing machine, an Olsen 20,000-lb. hand-power, wire testing machine, specially fitted for testing wooden columns with both fixed and pivoted ends, an Olsen 20,000-lb. hand-power universal testing machine, especially adapted for testing long columns, an Olsen torsion machine of 140,000 inch-pounds capacity for testing the strength and elasticity of shafts and rods up to 2 inches in diameter and 10 feet in length; a hand-power torsion machine of simple mechanical design for testing short shafts of a maximum diameter of one inch, a Riehle 5,000-lb. transverse load testing machine for flexural tests of bars of wood and metal up to 48 inches in length, an Olsen 200-lb. tension testing machine, designed for the testing of textiles.

There are also special machines, such as an Olsen (Izod) pendulum impact machine; Brinell, scleroscope, and Firth Hardometer for hardness testing; an Avery repeated stress (fatigue) machine of the rotating beam type; proving levers and standard weights, an elastic ring, and an Amsler 60,000-lb. box, for calibrating purposes.

The accessory equipment includes Berry and Olsen strain gauges, a Nalder dividing engine, Beggs deformeter gauges, a Fereday-Palmer stress recorder—an instrument ideally suited for determining stresses in actual structure — apparatus for measuring angular deformation, a strainometer for use in determining Poisson's ratio.

In addition to the above, there are available a large number of strainometers of the usual degree of precision. These include the Bauschinger, Martens, Unwin, Ames, Riehle, Johnson, Huggenberger, De Forest scratch gauge, and other types.

MINING ENGINEERING LABORATORIES

During 1931 the building containing these laboratories was entirely rebuilt and greatly enlarged. The new building is 72 ft. x 100 ft., and is four stories high with a basement under half of it. The top floor and part of the third are occupied by the assaying laboratories. The rest of the building is given up to the ore dressing and mining laboratories, the commodious library and study rooms, lavatory and shower baths, rooms for the staff, two rooms for research in ore dressing, a model and map room, and storerooms.

ASSAYING LABORATORY

The East and West Fire Assay laboratories occupy the top floor of the Mill Building. They are identical, with preparation, furnace, and

balance rooms in sequence, while between and common to these is a supply room, and another for chemical work. This arrangement allows a natural flow of operations from sample preparation to final weighing. Equipment in general is ample to give individual work to 32 students, thus encouraging original effort and conserving time.

The grinding rooms have a Sturtevant 2 x 6 jaw crusher, a McCool 8″ eccentric plate pulverizer, buck-boards, samplers, screens, and cupel machines. A special laboratory sampler gives samples of indisputable similarity, thus confining variations in students' assays, to their work.

Each furnace room has six Fletcher-Russell gas, and two D.F.C. oil furnaces. Parting cabinets have fan exhaust and direct illumination. Each student is allotted a work place equipped with a pulp balance, weights, tools, fluxes, and locker for individual work.

The bead balances are modern instruments by Ainsworth, Becker, Heusser, Keller, Oertling, Thompson, and Voland. Some have special rider devices and a sensitivity of 0.002 milligram. Each has independent lighting and is mounted on a cork insulated pier.

A sample room houses a wide variety of ores, mill products, mattes, bullion, and alloys from typical mines and smelters. Thesis, service, and study rooms on the third floor provide facilities and equipment for student research. Two staff rooms are used for the determinations necessary for instructional purposes and for research. A Hoskins electric furnace with Leeds-Northrup controllers and recorder is installed here. Other equipment includes pyrometers, microscope, electrolytic apparatus, and bullion rolls.

MINING LABORATORY

The Mining laboratory makes use of the ore dressing equipment as required. It is also equipped with an Ingersoll-Rand type ER-1 compressor and a variety of air driven rock drills representing the development of this machine. Blocks of synthetic ore for practising sampling and rock drilling are made up as required. A laboratory has been completed for the study of ventilation problems, air conditioning, dust counts, etc. In the main basement are bins for the accommodation of a large variety of ores from various mining districts.

ORE DRESSING LABORATORY

The main Ore Dressing laboratory, 72 ft. x 53 ft. x 22 ft. high, is equipped with the old five stamp battery with amalgamation plates, Wilfley table, Deister Plato table, Deister slime table, an old-fashioned buddle, and classifiers. Parallel with the stamp mill is a ball mill 30 in. x 24 in., which can be used alternatively with the stamps in connection with the concentrating tables. At one side of this main laboratory is apparatus representing the complete flow-sheet of a modern concentrator designed for continuous operation at the rate of 50 to 100 lb. per hour. This plant consists of feeders, two rod mills and a ball mill each 18 in. x

12 in., with classifiers, two Wilfley tables, a Dorr type thickener, a six-cell Fahrenwald Sub A flotation unit, a conditioner, a small pilot Wilfley table, and a Genter thickener. Another laboratory, 70 ft. x 25 ft., is set aside for batch work, and contains a variety of flotation machines, small ball and rod mills, small jigs, apparatus for cyanide tests and for tests in magnetic concentration. Other rooms are set apart for hand screening, microscopes, balances, a chemical room, and a room for roasting and other high temperature testing of ores in connection with ore dressing. For further research in ore dressing, there are available, Haultain Superpanners and Infrasizers, briquetting apparatus and metal lap machines for the polishing of briquettes in the study of minerals and mill products. The laboratory is also equipped with a Panphot microscope and accessories.

The Crushing laboratory contains a Hadfield gyratory crusher, a set of rolls 16 in. x 12 in., two small Dodge crushers, two sets of miniature rolls, two disc grinders, and a dry screening machine of the Feraris type. Adjoining this room is a large room for practising sampling methods.

MECHANICAL ENGINEERING LABORATORIES

HEAT ENGINE LABORATORY

Instruction in this laboratory covers the examination and testing of steam engines and boilers, and of internal combustion engines of the Diesel and automobile types, as well as stationary power units. Experiments on the octane rating of fuels, heating values of coal, etc., and the action of injectors and heat transmission apparatus are made. On the mechanical side, experiments are made on static and dynamic balancing, belt testing, oil testing, etc.

The part of the building set apart for thermodynamics and mechanical work is the ground floor of a room 60 ft. x 155 ft. This room is lighted entirely from the roof in an efficient way. A part of the space 40 ft. wide running the entire length of 155 feet is served by a 3-ton travelling crane, and contains the following equipment:

50 h.p. Brown engine with separate jackets on both heads and barrel of cylinder.

Two-stage Rand air compressor having compound steam cylinders, each fitted with Meyer cut-off gear. The low pressure air cylinder has Corliss inlet gear.

30 h.p. high-speed Leonard tandem compound engine with shaft governor.

40 h.p. Uniflow engine.

25 h.p. General Electric steam turbine.

Two 15 h.p. Leonard engines with different types of valves, which are used for valve setting, presented by E. Leonard & Sons.

Centrifugal air compressor.

There are also two surface condensers with air pumps so arranged that any engine in the laboratory may be made to exhaust into the atmosphere

through an open heater, or into one of the condensers, the change from one arrangement to the other being accomplished in a few minutes without the aid of valves.

The laboratory further contains:

A 3-ton York refrigerating machine with tanks.

An Amsler transmission dynamometer.

Apparatus for testing injectors and steam pumps.

Hot blast heating equipment.

Experimental air conditioning apparatus.

Numerous other pieces of apparatus and instruments.

The work on internal combustion engines is performed on the following:

14 h.p. National gas engine arranged for various compressions and points of ignition.

25 h.p. horizontal Diesel engine made by Ruston and Hornsby, especially arranged for testing.

25 h.p. Allen semi-Diesel engine.

25 h.p. tractor gasoline engine.

Six cylinder Chevrolet automobile engine. (Presented by the makers.)

200 h.p. Sprague electric dynamometer.

Eight cylinder Ford automobile engine. (Presented by the makers.)

Leyland six cylinder Diesel engine.

Hercules six cylinder engine for various fuels.

Standard C.F.R. fuel rating engine for finding the octane rating of fuels, etc.

Various accessories to above machines.

Steam for the laboratory is supplied by two 50 h.p. and one 100 h.p. Babcock and Wilcox boilers, the latter having an internal superheater. These boilers are located in a separate boiler room. They are used for experimental work only and are fitted up for testing. The gases pass up through two independent chimneys, and these have been arranged so that the draft and other conditions in the chimney at any point of its height may be examined.

In smaller work-rooms off the main laboratory are placed belt and oil-testing machines, and apparatus for testing the efficiency of machines.

A Carwen Olsen balancing machine for static and dynamic balancing has recently been installed.

HYDRAULIC LABORATORY

The Hydraulic laboratory is designed to give practical hydraulic experiments illustrating the laws of flow of fluids in pipes, through orifices, over dams, etc. Friction loss may be measured, and the action of various types of meters, with their coefficients, is examined. Measurements of the efficiency and best methods of operation of pumps, and of turbines of various types, are also determined and problems relating to water power development, also to the movement of fluids, find a place in this laboratory.

The laboratory occupies two floors, each 40 ft. x 112 ft., and the apparatus therein may be briefly listed as follows:

Two 2-stage Gwynne centrifugal pumps, each for one cubic foot per second at 125 feet head.

Two 2-stage Escher Wyss turbine pumps, each for one cubic foot per second at 150 feet head.

These four pumps may be run in parallel for four cubic feet per second at 125 feet head, or in any desired series arrangement giving one cubic foot per second at not over 550 feet head, thus allowing for a wide range of experimental work.

A 125 h.p. Belliss and Morcom engine of 525 r.p.m. for driving the four pumps mentioned, and for experiment if desired.

A motor driven turbine pump for six cubic feet per second at 65 feet head for supplying the turbines.

An open trough five feet wide and 110 feet long for towing models and meters, and for certain types of open channel work.

A small reciprocating experimental pump.

A four stage motor driven turbine pump for experiments.

An Escher Wyss reaction turbine, 13½-inch runner, built specially for the laboratory.

A 24-inch Pelton turbine specially constructed for study.

A 12-inch Doble impulse turbine.

A reaction turbine with both Francis and propeller runners designed for this University.

An experimental centrifugal pump and meters.

A Kaplan turbine also made for test purposes.

A concrete and steel flume built primarily for research work on turbines.

A Moody spiral pump, motor driven, for a delivery of twelve cubic feet per second at low head.

A very carefully designed dynamometer and efficient set-up to enable reliable efficiency tests to be made with great accuracy.

A vertical steel tank 5½ feet diameter and 34 feet high to be used as a reservoir, also for experiments on nozzles, valves, meters, etc.

A weir tank 6 feet wide and 21 feet long with hydraulically operated valves.

Two measuring tanks, each of 240 cubic feet capacity, each mounted on accurate scales and to be used to calibrate the weirs or to weigh large quantities of water.

Three tanks, each 3 feet wide and 12 feet long, for experiments on orifices and weirs.

Six measuring tanks for calibrating the above orifices, etc.

A glass sided trough 30 feet long for studies on weirs, dams, and similar structures.

Venturi meter, hydraulic ram, Pitot tubes, numerous models, gauges, gauge tester, and all apparatus necessary for the above mentioned studies. The laboratory piping has been designed to give wide variety of operation

of the system. Piping has been set up for friction and nozzle experiments and other work.

The laboratory is indebted to the Dominion Engineering Works, Montreal, and to the late Mr. William Inglis and others for generously supplying parts of the apparatus.

CHEMICAL ENGINEERING LABORATORIES

The Chemical laboratories are situated in the Mining Building, and are supplied with the usual modern equipment.

Seven large laboratories, each with its own balance room, and seventeen small laboratories are in steady use. Some of the latter are specially equipped for work in such fields as gas analysis, calorimetry, polarimetry, hydrogen ion investigations, and water analysis. A fireproof room is provided for work with volatile solvents and organic analysis, and special equipment for semi-micro analysis is permanently maintained. Nine of the small laboratories are set apart for undergraduate and graduate research, and a room is set apart for the construction of glass apparatus by the glassblower connected with the department, in which instruction in glassblowing is given to students. One of the large laboratories, approximately forty feet square, is equipped for the experimental study of chemical engineering and industrial chemistry. Among the apparatus installed there are: a stoneware column for the investigation of the absorption of gases by liquids, fractionating still, heat transfer apparatus filter press, vacuum evaporator, sulphonator, fusion pots, autoclaves, jacketed kettle, tanks, pumps, meters, and other necessary accessories. Each of these is used by undergraduates, and is further employed from time to time in research.

ELECTRICAL ENGINEERING LABORATORIES

The Electrical laboratories, located in the Electrical Building, are equipped for studies related to principles discussed in lecture courses rather than for routine tests.

The power services to all laboratories are 230-115 volts, direct current; 115 volts, three phase, 25 cycles; and 115 volts, three phase, 60 cycles. Power for the laboratories is supplied by the University Central Heating and Power Plant in the form of 230-115 volts, three wire, direct current. The alternating current services are supplied from two main motor-generator sets which are equipped with automatic voltage and speed regulators.

These different services, combined with a system of spare conductors, make it possible to conduct a great variety of experiments in any one of the laboratories. In all laboratories the measuring instruments are of the highest quality.

ALTERNATING CURRENT MACHINE LABORATORY

The Alternating Current Machine laboratory, located on the first floor, contains the main 25-cycle and 60-cycle service sets referred to above. For experimental purposes the following equipment is available: two 15 kva. motor generator sets, d.c. to 60-cycle a.c.; two 15 kva. motor generator sets, d.c. to 25-cycle a.c.; two 10 kva. 60-cycle phase displacement dynamometer sets; a 25 h.p. low speed (322 r.p.m.) 60-cycle synchronous machine which produces an emf. wave very close to sine form; a 5 kw. 60-cycle synchronous converter; a mercury-arc rectifier; transformers; a.c. motors of all types; a model transmission line; two electromagnetic and two cathode ray oscillographs; and all necessary auxiliary apparatus.

DIRECT CURRENT MACHINE LABORATORY

The Direct Current Machine laboratory, located on the second floor, has a 40 kw. 230 volts d.c. to 115 volts d.c. motor-generator set with Tirrill regulator for special tests. Other equipment includes a number of 5 to 10 kw. motor-generator sets for d.c. generator tests; shunt, series and compound motors with and without interpoles; and other necessary apparatus such as loading racks, rheostats, circuit breakers, prony brakes and motor starters.

ELECTRICAL MEASUREMENTS LABORATORY

The Electrical Measurements laboratory, located on the top floor, is fitted with a convenient arrangement of power supply including a very flexible storage battery service and a 1,000-cycle service in addition to the standard a.c. and d.c. services. The equipment includes galvanometers, resistance boxes, Wheatstone bridges, shunts, potentiometers, standard cells, bond testers, condensers, and such other apparatus required for making a great variety of studies in measurements by direct and alternating current methods.

COMMUNICATION LABORATORY

The Communication laboratory, located on the top floor, is equipped for setting up and measuring vacuum tube circuits of all usual types; and for measuring the properties of networks at both low and high frequencies. Cathode ray oscillographs, harmonic analyzers, amplifiers for bridge balance, etc., are available. A 1,000-cycle supply of good wave form is located at all measuring points in the laboratory. A separate room is treated acoustically and equipped with the necessary apparatus for the study of electrical reproduction of sound.

ENGINEERING ELECTRONICS LABORATORY

The Engineering Electronics Laboratory, located on the top floor, is equipped for experiments on electronic applications in the industrial power frequency fields. The equipment includes cathode ray oscillographs of twin beam and conventional types, hot cathode rectifiers, pool cathode

mercury arc rectifiers, thyratrons, ignitrons, photo-electric cells and the necessary auxiliary equipment much as power supplies, transformers, amplifiers, and measuring instruments. The equipment is so designed that circuits for the study of fundamental principles may be arranged easily and quickly. While typical commercial tubes and components are employed, they are used in such a manner as to give the greatest educational value rather than to illustrate finished commercial products.

METALLURGICAL ENGINEERING LABORATORIES

These laboratories, in the east end of the Mining Building, occupy approximately 3,600 square feet on the basement floor and the same space immediately above on the ground floor. The furnace room contains a motor driven Connersville blower, several gas-fired furnaces, and two small blast furnaces. The larger electric furnaces of the Department of Chemistry (Electrochemistry) are in this room. Some are supplied with direct current, others with alternating current from a 200 K.V.A. transformer. A system of flues, with hoods over all the furnaces, leads to a stack through which gases are pulled by a fan.

The department has recently installed a 50 k.v.a. 60 cycle service which permits the operation of modern experimental equipment. A 7.5 k.v.a. and a 15 k.w. 300,000 cycle high frequency converter (on loan from National Research Council) are available for special melting and heat treatment experiments. A Detroit Rocking Arc Furnace of latest type is now available for the production of ferrous and non-ferrous alloys.

Hydro-metallurgical equipment includes apparatus for leaching and electrolytic precipitation in circulating systems.

Situated in these two rooms, also, is most of the equipment used in the teaching of ceramics and non-metallic industrial materials. The apparatus includes a dry pan, a small dry press, a plunger machine with tile and hollow ware dies, an Abbé six-jar ball mill, a recuperative down draft clay testing furnace of brick construction, a small Seger test furnace, a high temperature oxygen acetylene furnace, a high temperature electric muffle furnace heated by "globars", and standard screens, volumeters, elutriation apparatus, driers, and such sundries as are necessary for clay testing.

The upper floor is divided into laboratories, a library, store rooms, and offices. The laboratories are for metallurgical analysis; heat treatment and pyrometry; grinding, polishing, and etching; metallographic room, with two adjoining dark rooms.

The laboratory for metallurgical analysis is well equipped to give students training in mill and smelter methods, the analysis of ores, furnace products, ferrous and non-ferrous alloys, and specialized ceramic bodies.

In the heat treatment and pyrometry laboratory there are a number of gas and electric furnaces, a Leeds and Northrup micromax potentio-

meter, a disappearing filament pyrometer, a radiation pyrometer, and thermocouples for use with millivoltmeter or potentiometer.

For grinding and polishing there are provided many sets of emery papers and six motor-driven polishing wheels.

The metallographic room is equipped with a horizontal Bausch & Lomb photomicrographic camera, a Leitz micro-camera attachment, two vertical cameras, and nine metallographic microscopes.

The laboratories also contain a "Tensometer" for making tensile tests, notch bar tests and Brinell tests on small test pieces, a Leeds and Northrup type "K" potentiometer for determining critical points, a Rockwell hardness testing machine, a Shore scleroscope, an emery cutting disc, and a mechanical saw.

The laboratory workshop is equipped with usual machine tools, together with acetylene and arc welding equipment.

APPLIED PHYSICS LABORATORIES

The Applied Physics laboratories, situated in the Engineering Building, are equipped as follows:

The Photometric laboratory is equipped with precision and portable photometers for the measurement of candle-power, illumination, and brightness; integrating spheres for determining the luminous output and efficiency of lamps and luminaires; and colorimeters, spectro-photometers, and flicker photometers for the measurement of colour. Standards of candle power, luminous flux, and colour temperature are maintained and a 132-volt storage battery with all electrical controls and meters necessary for precise photometry are provided.

The Illumination Design laboratory is equipped for demonstrating and measuring the performance of lighting installations.

The Optics laboratory is equipped with optical benches, etc., for the testing of lenses, and with examples of various optical instruments for instruction in their theory and applications.

The Photographic laboratory is equipped with cameras, dark rooms, and accessories for practical work in photography, and with sensitometers, spectrographs, and densitometers for the testing of photographic materials. A Zeiss phototheodolite, stereoscopes, stereocomparator, and plotting apparatus are provided for instruction in photographic surveying.

The Acoustical laboratory is equipped with the ordinary apparatus, such as forks, pipes, strings, etc., for illustrating the elementary laws of acoustics. There are also two rooms for work in sound transmission and absorption, equipped with an audio-frequency oscillator for the production of sounds of constant intensity, and microphones and amplifiers for, reception.

UNIVERSITY SURVEY CAMP

In 1920 the University purchased approximately 175 acres of land comprising a tract of field, woodland, and lake front property in the County of Haliburton, and erected permanent buildings for the use of students in Civil Engineering, Mining Engineering, Mining Geology, and Architecture, as well as for other students taking special work. The country is broken and rolling, and with the numerous small lakes and streams in the immediate vicinity, is admirably suited for work and the various problems that arise in practical surveying. The camp is at an elevation of about 1,000 feet above sea level and a secondary triangulation has been carried out, the stations of which are connected with the primary stations of the Geodetic Survey of Canada. Permanent bench marks have been established and connected up with the precise level net of Canada.

The Camp may be reached by the Canadian National Railways, via Lindsay to Gelert, where conveyances are always on hand to drive direct to the camp by way of Minden, a distance of 12 miles. There is also a daily bus service from Lindsay to Minden.

The Camp, located 4 miles south of Minden, on the west side of Gull Lake, can be reached by road after leaving the main Provincial highway at Minden. There are four main buildings, including a Dormitory, Administration, Staff, and Dining Hall Building, which are suitably furnished and provided with electric lighting and drafting accommodation. Accommodation for 80 students can be provided, and a large proportion of the equipment of the Department is transported to the Camp for use during the summer session.

The charge for accommodation at the 1948 camp will probably be $1.75 a day.

Mail, telegrams, or telephone messages should be addressed to "University Survey Camp, Minden, Ontario".

METROLOGICAL LABORATORY

The Department of Surveying and Geodesy is provided with all the ordinary field instruments, such as transits, levels, compasses, micrometers, sextants, planimeters, plane tables, tapes, chains, etc., with which is carried on the instruction in practical field operations as detailed elsewhere.

A small laboratory is also established in the basement of the observatory described below, containing the necessary instruments for the refined measurements of geodetic surveying; as, a standard yard and metre, a Rogers 10-foot comparator, an invar base measuring apparatus, a Kater's pendulum with vacuum chamber, a level trier, micrometer microscopes, etc.

The geodetic observatory in connection with this department is used for the instruction of students of the Fourth Year in taking observations for time, latitude, longitude, and azimuth by the precise methods used in connection with a geodetic survey. It contains a 10-inch theodolite and

zenith telescope by Troughton & Simms; an astronomical transit instrument and an 8-inch theodolite by Cooke; two electro-chronographs; a Howard astronomical clock; a Dent sideral clock; a Dent sideral break-circuit chronometer; a wireless receiving instrument; arithmometers, etc.

AERODYNAMIC LABORATORY

The Aerodynamic Laboratory is fully equipped with an improved 4-ft. Royal Aircraft Establishment type wind channel, aerodynamic balance, micromanometers and other necessary instruments.

Air speeds of 80 feet per second can be secured in a stream of great steadiness and uniformity and higher speeds with some sacrifice in steadiness.

The work done in the Laboratory includes the investigation of problems in aerodynamics, tests of air craft components, and complete machines, rating of meters, ventilators, radiators, etc., and the study of the effect of wind pressure on structures, chimneys, etc.

ONTARIO DEPARTMENT OF HEALTH LABORATORY

Through the courtesy of the Provincial Department of Health, the facilities of the well-equipped experimental laboratory, which the Department operates at Stanley Park (807 Richmond Street West), have been placed at the service of the University for the investigation of problems associated with all phases of Sanitary Engineering. Equipment and means are available for study and research in the various processes employed in sewage treatment, the different methods of water treatment, and the bacteriological and chemical examinations on water, sewage, air, milk, and all factors in sanitation.

ELECTROCHEMICAL LABORATORIES

The Electrochemical laboratories, which are situated in the Mining Building, are provided with special facilities for electrolytic work, including a large storage battery and electroplating dynamo with tanks, as well as a set of apparatus and electrical measuring instruments, for both undergraduate work and research. The experimental work on electric furnaces is carried out in a large furnace room in the basement, occupied jointly by the Department of Metallurgical Engineering and the Department of Chemistry (Electrochemistry). The equipment for this purpose comprises a 120 kw., 220 volt supply of direct current from the main power house through a switchboard, rheostats, circuit-breaker, and instruments to a set of distributing bus-bars, and a 200 k.v.a. transformer stepping down from 2,200 volts to 30-120 volts in 3 and 6 volt steps, which supplies alternating current at 25 cycles. There is a complete set of A.C. instruments, circuit-breakers, oil-switches, relays, automatic regulating winches,

etc., and a Northrup high frequency furnace with its transformer is also installed. The two departments co-operate in the use of a Hoskin carbon plate furnace and a resistor tunnel furnace. Facilities for the study of high current carbon arcs and the thermal behaviour of refractories are also provided.

GEOLOGICAL LABORATORIES

The Geological laboratories are equipped for the study of geology from the modern viewpoint. Collections of rocks and minerals, models and natural specimens illustrating various geological features, topographic and geological maps for exercises in map reading, and fossils are all employed in the study of general geology. Typical index fossils are utilized, along with geological maps, in historical geology.

In the Economic Geology laboratory, numerous suites of specimens of ores and rocks illustrate the nature and occurrence of the deposits in many mining camps. A set of building stones, uncut, cut, and polished, is available for a course on that subject. These materials are studied megascopically and microscopically to determine the character and associations of their mineral constituents. The Metamorphic Geology laboratory is supplied with specimens, thin sections, and petrographic microscopes for the study of metamorphic minerals and the changes that rocks undergo in thermal and dynamic metamorphism. Hand specimens and thin sections of suites of rocks from numerous Precambrian areas are also available for work in Precambrian geology. Facilities are available for sawing and polishing specimens of ores, and rocks, and for making thin sections.

For work in structural geology, natural specimens and geological maps exhibiting complex structural conditions and structural problems illustrated by diagrams and drill logs, are extensively employed. For field methods in geology, the laboratories are supplied with geological and topographic maps, survey instruments, and various other equipment, so that work in the laboratory may supplement that in the field.

MINERALOGICAL LABORATORIES

The Mineralogical laboratories in the Mining Building provide facilities for most types of investigation involving minerals, crystals, and rocks.

Courses in laboratory work in the personal examination of type sets of named minerals, crystals, and rocks serve to illustrate the introductory lectures. More advanced work is provided in the identification of unknown minerals by physical tests, blowpipe, and other methods.

To encourage the study of pure crystallography, the laboratories are supplied with goniometers of the various types, crystal models, appliances for the cutting of oriented crystal sections and for their physical examination. Practical petrography is carried on in rooms provided with type sets of rocks, both macroscopic and microscopic. Advanced students are

taught to make thin sections of rocks and polished section of opaque minerals, and to study them microscopically.

The laboratory for the preparation of thin sections of rocks and minerals is provided with electric diamond saws and grinding appliances for the various types of work incidental to the preparation of thin sections. It is also equipped for the preparation of polished specimens for the microscopic examination of the opaque ore minerals.

The department is equipped with petrological and mineralographical microscopes, so that it is possible to provide advanced students with instruments and sets of thin sections and polished minerals for their own special use. Sets of index liquids and a universal stage are available for students interested in more advanced methods for determining the optical properties of crystals.

A well equipped X-ray laboratory, with suitable goniometers for the study of crystal structure, is available to qualified advanced students.

MUSEUM

The ROYAL ONTARIO MUSEUM, with exhibits in Archaeology, Geology and Mineralogy, Palaeontology and Zoology, is situated at the southwest corner of Bloor Street and Queen's Park.

Students of the University in all departments are recommended to avail themselves of the privileges of the Museum, which, although under separate control, is intimately connected with the work of the University.

The museum is open on Sunday from 2 p.m. to 5 p.m., and on week days from 10 a.m. to 5 p.m. with the exception of Monday when it is closed all day. The admission is free for the public on Tuesday, Thursday, Saturday and Sunday. On other days an admission fee of fifteen cents is charged.

By a resolution of the Board of Trustees all regular students of the University may be admitted free on showing their registration cards.

SECTION XIII. DISCIPLINE

1. (*a*) There is vested in the Council of each federated university or college, and of each faculty, disciplinary jurisdiction over and entire responsibility for the conduct of their students in respect of all matters arising or occurring in or upon their respective buildings and grounds including residences.

(*b*) Disciplinary jurisdiction in all other cases as respects all students is vested in the Caput.

(*c*) The Students' Administrative Council, in the discharge of all duties entrusted to it, will be supported in the due discharge of those duties by the disciplinary power of the Caput.

2. No student will be allowed to continue in attendance, whose presence is deemed by the Council of his college or faculty to be prejudicial to the interests of the University. The continuance of any student in attendance at a course in the University or the receipt by him of official certificates of standing or of graduation, is subject to such exercise of the disciplinary power of the Caput as may be necessary to enforce the regulations of the University and to maintain standards of personal conduct acceptable to the University. In the exercise of its disciplinary power, in the interest both of the University and of the student, the Caput will take into consideration the conduct of the student both inside and outside the University premises. In all cases an appeal to the Board of Governors may be made.

3. Students proceeding regularly to a degree are required to attend the courses of instruction and the examinations in all subjects prescribed for students of their respective standing, and no student will be permitted to remain in the University who persistently neglects academic work.

4. All interference on the part of any student with the personal liberty of another by arresting him, or summoning him to appear before any tribunal of students, or otherwise subjecting him to any indignity or personal violence, is forbidden by the Caput and by the Councils of the colleges and faculties.

5. No initiation ceremony involving personal violence, personal indignity, interference with personal liberty, or destruction of property, may be held by the students of any college or faculty of the University, under the penalty of suspension or expulsion.

6. Any reception of the students of the first year in any college or faculty must be approved by the Council of that college or faculty, but such reception must not involve any infraction of the regulations of the two preceding paragraphs.

7. The organizing of a parade in the streets of the city, or the taking part in such parade without the permission of the authorities of the city

on application of the Students' Administrative Council, will be regarded as a breach of discipline.

8. The use of loud-speaking equipment in University buildings or grounds, whether stationary or moving, or whether operated by students or others, is forbidden except by permission of the Board of Governors or the Caput.

9. Any individual or individuals directly responsible for an undesirable feature in connection with any Stunt Night or other entertainment given under the auspices of a student organization will be subject to disciplinary action by the Caput.

10. A committee of staff and students appointed by the Council of the college, faculty or school concerned will provide effective supervision of the programmes of all Stunt Nights and other public entertainments and will see that the programme follows the script as approved by the Council concerned.

11. The holding of beauty contests or similar exhibitions by university students, whether under the name of the University or under the auspices of organizations recognized by the Caput, is forbidden.

12. The constitution of every university society or association of students in any college, faculty or school, and all amendments to any such constitution must be submitted to the Caput. Responsibility for the conduct and programmes of each society or association of students drawing its membership from a single college, faculty or school shall rest with the Council of the college, faculty or school concerned. Responsibility for the programmes arranged by the committees of Hart House and controlled by the Board of Stewards of Hart House shall rest with the Board of Stewards. Responsibility for the conduct and programmes of every other society or association of students shall rest with the Caput.

13. The name of the University is not to be used in connection with a publication of any kind without the permission of the Caput.

14. Students of any faculty or college on the premises of colleges or faculties other than those in which they are registered shall be subject to the regulations and penalties imposed by the administrative authorities of the premises concerned.

15. A student who is under suspension, or who has been expelled from a college or faculty or from the University, will not be admitted to the University buildings or grounds.

SECTION XIV—UNIVERSITY HEALTH SERVICE

I. *Membership:* Membership in the University Health Service is obligatory for all students, with the following exceptions:

(a) Women living in residence at Victoria College, for whom the college provides its own Health Service.

(b) Students in the Pass Course for Teachers, in the School of Law, in courses leading to the degrees of Bachelor of Science in Medicine, Bachelor of Science in Dentistry and Bachelor of Pedagogy; and certain graduate and occasional students.

Those for whom the fee is not compulsory may obtain membership in the Service on payment of the fee, provided this is done at the time of registration.

The Health Service maintains a close liaison with the Medical Service of the Department of Veterans Affairs.

II. *Objective:* The objective is the preservation and promotion of the students' health.

III. *Facilities:*

(1) Annual Medical Examination. By order of the Board of Governors, a medical examination by the Health Service is compulsory each year for:

(a) All new undergraduate students.

(b) Any student before taking part in Athletics or the required physical training program.

The examination is optional for all others but they are urged to avail themselves of the privilege of this annual medical consultation.

(2) X-ray Chest Survey for Pulmonary Tuberculosis. By order of the Board of Governors, the following groups of students must have an x-ray examination of the chest as arranged by the Health Service:

(a) All new students.

(b) All final year students.

(c) All Medical students (annually).

(d) Any student for whom it is considered necessary.

(3) A Consultation and Emergency Service. Any student may consult a Staff Physician at the Health Service between the hours of 9 a.m. to 5 p.m., Monday to Friday, and 9 a.m. to 1 p.m. Saturday.

(4) Athletic Injury Service. The University does not accept any responsibility for injuries sustained by students while engaged in physical education classes or in University athletic activi-

ties. At the discretion of the Director, however, treatment of minor conditions may be provided. Such treatment will be provided at the Men's and Women's Health Service and Hart House Surgery, under an agreement with the University Health Service. The expense of treatment obtained outside of the Department of Health Service will be met only if approved by the Director.

(5) Health Education. The Health Service provides lectures on subjects related to the preservation and promotion of health.

For students living away from home who have not a private physician the following services will, when available, be provided for a nominal additional charge. In the case of students on rehabilitation grants, these charges will be borne by the Department of Veterans Affairs.

(6) A Visiting Service. An initial visit for advice and disposal will be paid. A nominal charge of $1.00 during the day (9 a.m. to 6 p.m.) and $2.00 at night (6 p.m. to 9 a.m.) is made for each visit and is payable to the Chief Accountant.

(7) An Infirmary Service. This service is for the treatment of minor illnesses only. A charge of $3.00 per day, payable to the Chief Accountant, is made to cover cost of meals, nursing and routine medications.

IV. *Appointments for Medical Examination:* Health Service examinations commence immediately after Labour Day in September. The examinations are by appointment only. The importance of keeping and being on time for the appointment, as made, cannot be overemphasized. Appointments for all faculties except Arts, are made through the class president. Arts students and members of the other faculties who cannot conform to the times arranged through their class presidents may contact the Health Service direct. First Year students and those proposing to engage in athletic activities will be examined first and the examinations should be completed before October 15. The remaining years are done in succession, examinations being completed early in March. Appointments for x-ray examinations of the chest are made, if possible, when the student reports for his health examination, or through the class president, or by direct contact with the Health Service. The Varsity should be carefully watched for notices relative to all appointments.

V. *Communicable Diseases:* Any student who has suffered from one of the communicable diseases must report to the Health Service prior to returning to the University.

VI. *Fee:* The Health Service Fee is $5.00.

VII. *Directory:*

	Address	Telephone
Health Service (Men)	43 St. George Street	MIdway 9644
Hours Open: Monday to Friday, 9 a.m. to 5 p.m.; Saturday, 9 a.m. to 1 p.m.		
Health Service (Women)	43 St. George St.	MIdway 2646
Hours Open: Monday to Friday, 9 a.m. to 5 p.m.; Saturday, 9 a.m. to 1 p.m.		
Hart House Surgery	Hart House	MIdway 5838 local 201
Hours Open: Monday to Friday, 5 to 6.30 p.m.		
Infirmary (Men)	42 St. George St.	MIdway 5838, local 201
Infirmary (Women)	Women's Union, 79 St. George Street	KIngsdale 8163

Accidents which occur after 6.30 p.m. (or 1 p.m. on Saturday) or are of a sufficiently serious nature as to require immediate hospital attendance should be taken:

Men: To the Emergency Department of the Toronto General Hospital, College Street.

Women: To the Emergency Department of the Women's College Hospital, 76 Grenville Street.

To obtain a physician after hours call KIngsdale 8163.

UNIVERSITY HEALTH SERVICE, AJAX DIVISION

All rules, regulations and services as outlined above for the University Health Service, will apply to Ajax Division of the University Health Service.

The Ajax Division of the University Health Service is located in the University Hospital on King's Road in the northern area of the Ajax grounds.

The Hospital is fully equipped to handle all emergencies and arrange for their transfer, if indicated, to a general hospital in Toronto or the near by communities. An ambulance is available at the Hospital at all times. There is adequate bed space to care for minor accidents and illnesses. The Hospital is equipped with a small surgery, laboratory facilities, X-ray equipment and isolation wards. Graduate nurses are in charge and medical supervision is provided by the Health Service physicians. Admission to the Hospital is on the authority of a staff physician of the Health Service.

First aid in the event of sudden illness or accidents is available at all times by telephoning the hospital, Local 116, where a physician is on duty or call.

PHYSICAL TRAINING

By order of the Board of Governors, each man proceeding to a bachelor's degree must take physical training during the first and second years of his attendance at the University. The physical training requirements include a swimming test which must be taken before November 1st by all first year men, by men admitted to the second year from other universities, and by those repeating the first year. All men required to take physical training must register at the Key Office in Hart House before October 15th. All students before taking part in athletics or the required physical training must first undergo a medical examination by the Health Service. Arrangements for this examination may be made at the University Health Service, 43 St. George Street, at any time after September 1st and should be completed by October 15th.

By order of the Board of Governors each woman proceeding to a Bachelor's degree must take Physical Training during the first year of her attendance at the university. Before October 10 in the session in which Physical Training is compulsory she must register for Physical Training at the gymnasium office, 153 Bloor Street West, and before October 15th apply for a medical examination by the University Health Service at 44 Hoskin Avenue. Swimming classes are compulsory for all students who do not pass the required swimming test. Students of all years who wish to take part in any form of athletics or physical exercise must first undergo a medical examination by the Health Service.

The student who has failed to complete satisfactorily attendance at the classes in Physical Training prescribed for the first year will not be permitted to register in the third year: and the student who has failed to complete satisfactorily attendance at the classes in Physical Training prescribed for the second year will not be permitted to register in the fourth year.

The student who has neglected to complete satisfactorily attendance at the classes in Physical Training of the first or second year must take this work during the second or third year respectively of his attendance at the University, and will be required to pay an additional supplemental fee of $10.00.

SECTION XV. HART HOUSE

Hart House, the gift of the Massey Foundation, is so called in memory of Mr. Hart Massey. This House, which is for the use of men only, is far more than a students' club. In its widest interpretation it seeks to provide for all the activities in the undergraduate's life apart from the actual work in the lecture room.

Hart House contains under one roof a dining hall, together with a shop where light refreshments are served, common-rooms, library, debates room, music room, a small chapel together with rooms for the use of the Student Christian Movement, an art gallery, an arts and crafts room, photographic rooms, gymnasia, swimming pool, running track, rifle range, and theatre.

The House is open from 8 a.m. to 11 p.m. daily. Meals are served to students in the Great Hall from Monday to Saturday lunch. Members are entitled to full privileges of all rooms in the building between these hours and the use of the gymnasia, pool, showers and locker rooms until 9 p.m. each day except Saturday and Sunday, subject to the regulations of the Athletic Association. On Saturday the pool, together with the rest of the athletic wing, closes at 5 p.m.

The Warden is entrusted with the general supervision of the whole House, but the athletic wing is under the direct control of the Athletic Directorate. In great measure the care of the House and its welfare are entrusted to the students themselves. There are a number of committees, most of which consist of ten undergraduates, three senior members, and the Warden. The undergraduates on all these committees are elected annually by the undergraduate members of Hart House. The undergraduate secretaries of seven of these (House, Library, Music, Art, Camera, Debates, and Squash) together with certain appointed representatives, sit on the Board of Stewards, the governing board of the House, which is directly responsible to the Governors of the University. Of this Board the Warden is ex-officio chairman. The Comptroller, the Assistant Comptroller, the Graduate Secretary, and the Assistant to the Warden of Hart House are responsible for the administration.

All men undergraduates proceeding to a degree in the University are members of Hart House. The annual fee (September to May) is $12.00. To prevent the use of the building by unauthorized persons every member should carry his registration card and show it on request. Any member wishing to introduce a guest should obtain a card from the Warden's office.

Occasional students are not ordinarily eligible for membership in Hart House, but may make application to the Graduate Secretary's office for election by the Membership Committee.

Graduate students, graduates of this university resident in Toronto, and out of town graduates are entitled to the full privileges of Hart House when they have been duly elected and have paid the annual fee.

HART HOUSE THEATRE

For the first time since its inception in 1921 Hart House Theatre is now under the direct administration of the University of Toronto.

This has been made possible through the generosity of the trustees of the Massey Foundation, particularly the Right Honourable Vincent Massey and Mrs. Massey. Under the Massey Foundation and with the assistance of outstanding directors the Theatre established an enviable reputation in Little Theatre activity throughout North America.

Control of the Theatre is now vested in a Board of Syndics appointed by the Board of Governors of the University. The present purpose of the Theatre is the encouragement of Dramatic Art in all its aspects, particularly among the undergraduates of the University. For this purpose the Theatre now has a resident director and competent staff who are available for consultation and assistance.

THE SOLDIERS' TOWER

To commemorate the sacrifice of those graduates and undergraduates of our University who gave their lives in the Great War (1914-1918), the graduates have erected the Soldiers' Tower. Situated at the southwest corner of Hart House, the Tower rises—a symbol of sacrifice—and with its screen forms a majestic link between Hart House and the old Main Building. Beneath the sheltering arches of the screen, the names of the six hundred and eighteen, to whom the memorial pays its proud and affectionate tribute, are cut deep in the stone. Above, in the belfry of the Tower, is a carillon that, as it chimes, weaves a fabric of memories for professors and students who take up the tasks laid down by those who fell.

HART HOUSE AJAX

Like its namesake, Hart House Ajax seeks to provide for the many activities in the undergraduate's life which lie outside the lecture room and laboratory. The main building, situated south of York Hall, contains a large common room, music room, record room and a shop where snacks are available. The common room serves also as an art gallery and the record room is used by members for playing the collection of fine recordings owned by Hart House Ajax. In three other buildings in close proximity to the student residences are facilities for drama, a Camera Club, Hobby Club, Amateur Radio Club (VE3BPD), motion pictures, dancing and five-pin bowling. From this it will be observed that Hart House Ajax is not one building but really a collection of buildings in which every effort is made to embody the Hart House "idea".

The small chapel, which is available for use by all members, is under the direction of the Rev. Carl Swan whose room is adjacent to the chapel. The library, which is for leisure reading, contains a wide selection of books of general interest. The books in this room must not be removed. Those wishing to take books to their rooms are referred to the Circulating Library

maintained by the University for Ajax students. Musical activities, consisting in the main of recitals given by outstanding artists on alternate Thursday evenings, and "Record Hours" at regular periods have become well established at Hart House Ajax. There is also a Hart House Ajax Glee Club which is under the direction of Mr. C. E. Olive. The club is comprised of undergraduates and staff who sing for their own enjoyment. All members of Hart House Ajax are invited to participate. Students interested in the Drama Club are advised to consult Mr. H. V. Brock who is responsible for this activity at Ajax. Camera Club rooms, provided with necessary equipment, are open to members of Hart House Ajax on payment of a fee to cover the expense of chemicals. A small deposit, in addition, is taken for door and locker keys. The Hobby Club, Amateur Radio Club and Chess Club are open to members of Hart House Ajax on the same basis.

All undergraduates enrolled in the Ajax Division are members of Hart House Ajax and, through the courtesy of the Board of Stewards, an invitation has been extended for male members of Hart House Ajax to make full use of the facilities of Hart House when in Toronto.

The Supervisor of Hart House Ajax is responsible for its general supervision, but in great measure the care of Hart House Ajax and its welfare is entrusted to the students themselves through the various Hart House Ajax committees. These committees are comprised mainly of undergraduates who are elected by the undergraduate members, and on each committee two senior members also serve. The administrative staff of Hart House Ajax consists of Mr. D. L. Emond, Supervisor, Mr. R. H. Loken, Assistant Supervisor, and Mr. H. V. Brock, Assistant in the Supervisor's Office.

SECTION XVI. STUDENT ORGANIZATIONS

STUDENTS' ADMINISTRATIVE COUNCIL

The Students' Administrative Council is composed of the Presidents or elected heads of the official undergraduate organizations of each college and faculty of the university, including Ajax. The Students' Administrative Council publishes *The Varsity, Torontonensis* and the *Students' Handbook.* It represents the students at university functions and on public occasions and receives and administers all funds accruing from Students' Council fees, revenues from publications, and such other funds as shall become the property of the Council, and through its Secretaries it organizes such intercollegiate and university activities as may be of interest to the student body as a whole.

The Council operates an employment bureau for men and women undergraduates for summer, Christmas and part-time work. It operates a housing service for men and women undergraduates and a loan fund for men and women undergraduates in the final two years of their courses. Application for loans must be made to the General Secretary-Treasurer. of the Students' Administrative Council. The maximum loan is $100.00. A short-term emergency loan fund is available to ex-service personnel pending receipt of maintenance grants or war service gratuities.

The sale of official university jewellery, crests, and so forth, and orders for official blazers are looked after by the Council.

The Council office is located in Hart House, the Women's Office is located in room 82, University College, and a Students' Council office is maintained at Ajax, located in Ajax Hart House, which provides all Council services for Ajax students. The annual fee paid by all undergraduates proceeding to a degree provides for a subscription to the publications of the Council to which the student is entitled and makes available to them all the services of the Council, including the loan fund. The fee also covers the administration costs of the Students' Administrative Council.

The Students' Administrative Council is prepared to make to ex-service personnel emergency loans pending receipt of their entitlements under the Educational Benefits provided in the Post-discharge Re-establishment Order.

UNIVERSITY OF TORONTO ATHLETIC ASSOCIATION

By the authority of the Board of Governors University athletics for men are under the control of the University of Toronto Athletic Association of which the executive body is the Athletic Directorate consisting of:

the President of the University,
two members of the faculty, appointed by the President,
two graduates, appointed by the Athletic Advisory Board,

the Director of University Health Service, the Director of Athletics and the Financial Secretary (*ex-officio*),

five undergraduates, elected annually, from the student body,

an undergraduate representative, appointed by the Men Students' Administrative Council.

Under the authority of the Board of Governors the Athletic Directorate shall have full control of the administration of the funds of the Association, which are used in furthering the development of competitive and recreational athletics for University students.

The Directorate subject to the approval of the President is empowered by the Board of Governors to control and administer the compulsory Physical Training programme required by the Board of all men undergraduates during the first and second years of their attendance. The Directorate shall also control and administer the voluntary programme in Athletics and Physical training available to men undergraduates of all years.

The Directorate alone has the power to sanction the use of the name "The University of Toronto" in connection with men's athletics, and no men's athletic event can be held in the University without its approval. It has full control and direction of the gymnasium, the swimming pool, the locker rooms, showers and other conveniences in connection with athletics in Hart House, the athletic fields, stadium and ice arena.

The Supervisor of Athletics and Recreation, Ajax Division, subject to the approval of the Athletic Directorate, is empowered to establish and administer a fully developed programme of athletic activities for students attending the Ajax Division.

The annual athletic fee which is included in the incidental fees provides the same privileges for Ajax students as is available to students on the Toronto campus, subject to the limitations imposed as a result of inadequate facilities.

UNIVERSITY OF TORONTO WOMEN'S ATHLETIC ASSOCIATION

By the authority of the Board of Governors University athletics for women are under the control of the University of Toronto Women's Athletic Association of which the executive body is the Women's Athletic Directorate consisting of:

the President of the University,

two women members of the faculty, appointed by the President,

two women graduates, elected by the Women's Athletic Advisory Board,

the Assistant Director of University Health Service in charge of Women, the Physical Director for Women, and the Financial Secretary (*ex-officio*),

five women undergraduates, elected annually,

one woman undergraduate, appointed by the Students' Administrative Council.

The Directorate, subject to the approval of the President and the Physical Director for Women, is empowered by the Board of Governors to control and administer the compulsory Physical Training programme required by the Board of certain women undergraduates during the first year of their attendance. The Directorate also controls and administers the voluntary programme in Athletics and Physical Training available to women undergraduates of all years.

The Directorate alone has the power to sanction the use of the name "The University of Toronto" in connection with women's athletics, and no athletic event for women may be held in the University without its approval.

Under the authority of the Board of Governors, the Women's Athletic Directorate administers the funds of the Association which are used to further the development of competitive and recreational athletics for undergraduate women.

UNIVERSITY OF TORONTO ENGINEERING SOCIETY

The Engineering Society of the University of Toronto, being inaugurated in 1885, is the oldest undergraduate Engineering Society in Canada. Every student enrolled in the Faculty of Applied Science and Engineering is a member.

As set forth in its Constitution the objectives of the Engineering Society are:

(*a*) The encouragement of original research in Engineering.
(*b*) The preservation of the results of such research.
(*c*) The dissemination of these results among its members.
(*d*) The cultivation of the spirit of mutual assistance and cooperation among the members of the Society in the preparation for, and in the practice of, the Profession of Engineering.
(*e*) To afford an official means of communication between the student-body and the Faculty Council, the University authorities, and the students of other Faculties.

The Engineering Society consists for purposes of organization of a Federation of Clubs which may be listed as follows:

(*a*) The Civil Club of the Engineering Society, composed of the undergraduates in Civil Engineering.
(*b*) The Mining and Metallurgical Club of the Engineering Society, composed of the undergraduates in Mining Engineering, Metallurgical Engineering and Mining Geology.
(*c*) The Mechanical Club of the Engineering Society, composed of the undergraduates in Mechanical Engineering.
(*d*) The Electrical Club of the Engineering Society, composed of the undergraduates in Electrical Engineering.
(*e*) The Architectural Club of the Engineering Society, composed of the undergraduates in Architecture.

(*f*) The Industrial Chemical Club of the Engineering Society composed of the undergraduates in Chemical Engineering.
(*g*) The Engineering Physics Club of the Engineering Society, composed of the undergraduates in Engineering Physics.
(*h*) The Aeronautical Club of the Engineering Society, composed of the undergraduates in Aeronautical Engineering.
(*i*) The Engineering and Business Club of the Engineering Society, composed of the undergraduates in Engineering and Business.
(*j*) The Debating Club of the Engineering Society, composed of the undergraduates in all departments.

These clubs devote themselves to subjects of special interest to their members. Each club holds meetings at regular intervals when papers are read and discussions of a technical nature take place. The club members have the privilege of listening to prominent men in their field and also making frequent field trips to industrial plants.

"Transactions and Year Book" is the official Society publication covering the year's activities. The "Toike Oike Quarterly" is the literary publication of the Society.

The Society also maintains a Supply Department which carries all student supplies with the exception of text books. Profits from the store are used to subsidize the Engineering Society's social functions.

FACULTY OF APPLIED SCIENCE ATHLETIC ASSOCIATION

Affiliated with the Engineering Society is the Faculty of Applied Science Athletic Association.

The Athletic Association has full control over all athletic clubs using the name of the Faculty of Applied Science. The Executive Committee has power to suspend anyone from the privileges of membership in the Association for any breach of its regulations, and controls the finances of all athletic clubs in the aforesaid Faculty. The annual membership fee of this Association is two dollars.

No other moneys are collected for the support of athletics in the Faculty of Applied Science without the sanction of the Executive Committee.

STUDENT CHRISTIAN MOVEMENT

The Student Christian Movement in the University of Toronto is part of an international fellowship of students in the colleges and universities of the world, the World's Student Christian Federation. Based on the conviction that in Jesus Christ are to be found the supreme revelation of God and the means to the full realization of life, the Movement seeks through a programme of study, prayer and practice to understand the Christian faith and to live the Christian life by uniting in its fellowship all students who share its basic convictions as well as those who wish to test their truth.

Among the methods employed by the Movement in seeking to realize its purpose are study groups, worship services, forum discussions, conferences, lectures, work projects, and social services. Of special interest to Engineering students are the "Student-in-Industry" camps which are carried on during the summer vacation periods in industrial communities.

The programme is open to all interested students. It is not necessary to "join" in order to share in the activities of the Movement. On the Toronto campus full information may be obtained from S.C.M. executive members in the various colleges, the names of whom will be found in the *Students' Handbook*, or from the S.C.M. offices in Hart House and the Household Science Building. Students at Ajax are invited to make the acquaintance of the resident chaplain, the Rev. L. Carl Swan, in Hart House Ajax and to participate in the life and work of the university community church which is under his direction.

VARSITY CHRISTIAN FELLOWSHIP

The Engineering Branch of the Varsity Christian Fellowship is affiliated with the campus-wide Varsity Christian Fellowship which in turn is a part of the world-wide Inter-Varsity Christian Fellowship.

The Fellowship is founded on the historic fact that God has revealed Himself in the life, death, and resurrection of His Son, Jesus Christ; that personal faith in Him results in the forgiveness of sin, victory over sin, and a new joyful life purpose. The Fellowship is seeking to bear witness to the vitality of this faith and to the power of the Saviour in every relationship of life.

Through the activities, which are open to all undergraduates, it seeks to show the applicability of these principles to an individual in business or professional life.

These activities embrace (*a*) daily prayer meetings at 8.15 a.m. in Hart House Chapel, (*b*) weekly noon-hour meetings on Tuesdays and (*c*) special events such as dinners, firesides, and sing songs. The officers are listed in the *Students' Handbook* and announcements are made in the *Varsity*.

THE JOINT HOUSE COMMITTEE
AJAX DIVISION RESIDENCES

The Joint House Committee, composed of the elected student Chairman from each residence, undertakes to regulate the residence life of the students. Its major duties and responsibilities are:

1. To promote, co-ordinate and direct the domestic and social activities of the residences.
2. To encourage the athletic activities of the students in residence.
3. To bring to the attention of the proper authorities any matter which concerns the welfare of the students in residence.

4. To hold an investigation into any matter involving one or more houses, and to impose penalties; or make recommendations to the Residence Committee, where necessary.
5. To recommend to the Residence Committee that fines and/or penalties be imposed on any individual or group of individuals or on a specific residence, if such action seems warranted.

The Joint Committee elects from its own number an executive committee composed of a Chairman, Vice-Chairman, Secretary-Treasurer, Social representative and a Member. One of this number acts as a liaison member between the Joint House Committee and the Food Service Department, and another acts as a liaison member between the Joint House Committee and the "Varsity".

UNIVERSITY OF TORONTO

UNIVERSITY NAVAL TRAINING DIVISION

The University Naval Training Division (UNTD) was formed in the spring of 1943 by Naval Service Headquarters, the primary purpose being to prepare students for eventual active service with the Royal Canadian Navy during hostilities. The peacetime purpose of the UNTD is to keep students interested in the Royal Canadian Navy and to qualify them as potential officer material for commissions in either the Permanent Navy or the Naval Reserve.

Unlike men of the Royal Canadian Navy who are enlisted for five years' service, students in the UNTD are attested on the Active List of the Royal Canadian Navy (Reserve).

Students in the UNTD, University of Toronto, are part of the complement of H.M.C.S. "York", and their administration, training, and discipline are under the jurisdiction of the Commanding Officer, H.M.C.S, "York".

While enrolled in the UNTD students wear uniforms similar to those of seamen in the R.C.N. Students may wear uniforms only on parade nights.

Students entering the UNTD are attested as Ordinary Seamen unless their academic field is allied to a branch of the Navy in which they might become commissioned. In such cases students are entered in the lowest rating of the branch concerned, e.g.:

(a) Students in Mechanical Engineering as Stokers Second Class.
(b) Students in Electrical Engineering as Electrical Artificers Fifth Class.
(c) Students in Commerce and Finance and Law as Probationary Writers.
(d) Students in Medicine as Probationary Sick Berth Attendants.

UNTD ratings are given a minimum of sixty hours' training during the academic year and two weeks' naval training with substantial rates of

pay at the Coast during the summer months. The syllabus of training is progressive from year to year and covers basic training courses with advanced courses in the third and fourth years.

The Ship's Office of the UNTD is located at 119 St. George Street, telephone MIdway 9837.

Area Commanding Officer......Commander G. F. McCrimmon, RCN(R)
Commanding Officer...........Lieutenant Commander (SB) D. A. F. Robinson, RCN(R)

UNIVERSITY OF TORONTO CONTINGENT CANADIAN OFFICERS TRAINING CORPS

In view of the record of the officers who received their training in the COTC before and during the war, the Director of Military Training at Canadian Army Headquarters has stated that this Corps is now looked upon as the chief source of officers for the Canadian Army.

A student who completes his training in the COTC is granted a commission as a lieutenant in the Canadian Army upon graduation and may join the Active Force (permanent army), if vacancies are available, or the Reserve Force. He is, however, under no obligation to do so but may remain on the Supplementary Reserve (inactive list).

Training is organized into two portions:

(a) Practical training, twelve to sixteen weeks each summer at Active Force Schools.

(b) Theoretical training, lecture courses during two academic sessions; not more than forty lectures per year.

Pay during the summer is $135 per month, and for those completing each theoretical lecture course, an additional ten days' pay. During summer training, board, lodging, clothing and transportation from the University to Corps Schools and return, is all provided free of charge.

To be eligible, students must be between eighteen and twenty-two years of age, British subjects, physically fit, and following a course of study leading to a University degree. Exceptions as to age are made in cases where a student was in one of the services during the war.

Arrangements have been made so that summer training may be reduced and will not interfere with the summer practical work required in certain faculties and courses.

Application for training should be made in person before the 15th of October to Contingent Headquarters, 119 St. George Street, Toronto. Previous experience has been that many more applications are received than can be accepted. Ajax students may apply at a time and place to be posted on the first of October on the notice board at Hart House (Ajax).

The Contingent Staff is:

Honorary Colonel........Colonel H. J. Cody, C.M.G., E.D.
Commanding Officer......Lieutenant-Colonel M. B. Watson, E.D., m.s.c.
Second-in-Command......Major W. L. Sagar
Adjutant...............Captain J. H. Potts
Resident Staff Officer.....Major H. W. F. Appleton, E.D., s.c.

UNIVERSITY ADVISORY BUREAU FOR EX-SERVICE STUDENTS

Under authority of the Board of Governors of the University, an Advisory Bureau for Ex-Service Students has been operating at the University since 1945. Designed to assist ex-service students in their re-adjustment to civilian and academic life, the Bureau seeks to aid by performing certain definite functions:

(a) Liaison with D.V.A. The Bureau works closely with the Department of Veterans Affairs, both locally and with Ottawa headquarters, on all matters affecting the interests of ex-service students and in many ways serves as a campus clearing house for problems which might otherwise require to be referred to the Toronto office of D.V.A. During the past year an authorized officer of D.V.A. has maintained office space in the Bureau and has been of invaluable assistance in clearing locally problems falling within the province of his department.

(b) Through liaison with the University departments, the Registrars' offices and appropriate services on the campus, the Bureau furnishes information and assistance in the financial, educational and personal spheres. The Bureau, for instance, serves as a focal centre for applications to The Veteran-Students' Loan Fund and provides information on other loan facilities, including Navy and Air Force Benovolent Trust Funds. Working with appropriate Registrars' offices, the Bureau helps the student to clarify details regarding entrance requirements, courses of study and related occupational goals. The Bureau is also available for consultation on personal questions involving adjustment to University life, assessment of interests, vocational direction and other matters of a similar nature; where advisable, students are referred to more specialized services.

(c) Liaison with other universities. In contact with the Advisory Bureaus located at other Universities across Canada, the Bureau seeks to maintain up-to-date information on local variations in all fields significant to ex-service students—entrance requirements and application deadlines, courses available, length of training, degrees awarded, etc.

Over-all policy relating to the Bureau is controlled by the President's Advisory Committee for ex-service students. The personnel consultants associated with the Bureau have for the most part seen service in the late war and have been associated with the Personnel or Rehabilitation Directorates of the Navy, Army or Air Force.

The Bureau serves the Queen's Park campus through its office at 67 St. George Street, and the Ajax campus through its office in Hart House, Ajax.

SECTION XVII. LODGING AND BOARD

Housing Service for Students

For students who are not accommodated in the University and College residences, the Students' Administrative Council prepares annually a list of inspected and approved rooming houses, flats, apartments and homes. This list may be consulted at the office in Hart House after August 1st and throughout the session.

To meet the housing shortage in Toronto, the Students' Administrative Council this year has greatly expanded its Housing Service. Every effort is being made to provide family accommodation for married ex-service students. Information may be obtained from the Students' Administrative Council's Housing Service office, Hart House.

RESIDENCE FOR MEN

Through the generosity of the late E. C. Whitney, Esq., Mrs. Whitney, and friends, the University offers to approximately one hundred and fifty men the advantages of residential life within its own grounds. The Residence consists of three Houses: South, East and North.

The regular rates are $4.00 a week for a single room or half of a suite (two bedrooms and common study). Occupants are required to pay their residence dues in two instalments, the first instalment, for the Michaelmas term, on entrance and the second instalment, for the Easter term, in January.

Except under very special circumstances, occupants will be required to remain in the Residence for the full academic session. Occupants who obtain permission to withdraw will be required to give two weeks' notice and to forfeit their deposits.

Applications for rooms must be submitted to the Secretary of the Residence Committee, Registrar's Office, Simcoe Hall. Forms for this purpose will be supplied on request. As early as possible the summer preceding attendance at the University, each successful applicant will be notified of his assignment. He must then send to the Secretary of the Residence Committee a deposit of $5.00. On receipt of this he will be sent an assignment card. Cheques or money orders must be made payable to the University of Toronto. The deposit will be returned if the applicant is not admitted, but will be forfeited if written notice of non-acceptance of a room assigned is not received by the Secretary before September 15th. If such notification is not received until after the opening of the session, the applicant will forfeit his deposit and will be required to pay a penalty of two weeks' room rent. On request the deposit will be refunded in full at the end of the college year if the room key is returned and the room and furniture left in a satisfactory condition.

The University lays down three general rules designed to prevent hazing, gambling, and the use of intoxicants.

A circular giving further information may be obtained from the Secretary of the Residence Committee.

AJAX DIVISION RESIDENCES

The residences at Ajax accommodate approximately 50 or 80 students each, depending on the type of building. All residences are equipped with study rooms, kitchenette, common room, telephone and other facilities. Students are accommodated two to a room.

The charge for room and board for the session will be approximately $270.00.* It should be noted, however, that:

(a) Meals included in the above rate are from Monday to Friday, inclusive.

(b) Saturday and Sunday meals are on a cash basis.

(c) Meals during vacation periods are not included in the above rate. Such meals are on a cash basis.

All meals are served in the University Cafeteria.

A student is required to remain in residence for the entire session. Permission to withdraw may be given by the Residence Committee, only in exceptional circumstances.

Students in residence are required to abide by the Residence Regulations (Ajax) laid down by the Residence Committee, and the three general University rules prohibiting hazing, gambling or the presence and use of intoxicants on University property.

Application forms for admission to residence may be obtained from the Registrar's Office, Simcoe Hall, Toronto, or the Supervisor of Residences, Ajax Division, Ajax, Ontario. The completed application must be accompanied by a deposit of $5.00 which will be returned if the applicant is not admitted. The $5.00 deposit will be refunded at the end of the session, if the room key is returned, and the room and furniture left in a satisfactory condition.

The completed application together with the $5.00 deposit should be forwarded as early as possible to the Bursar's Office, Ajax Division, University of Toronto, Ajax, Ontario. Residence dues are also payable at the Bursar's Office, as above.

If a student, after making application, will not require his room, he should so inform the Supervisor of Residences as soon as this fact is known.

Enquiries concerning residences should be addressed to the Supervisor of Residences, Ajax Division.

*In view of the increasing costs of supplies and labour, residence dues are subject to change by the Board of Governors.

SUMMARY OF STUDENTS IN ATTENDANCE

Session 1946-47

Year	Course 1	2	3	4	5	6	7	8	8a	9	10	11	Total
I....	266	92	378	94	124	296	306	66	12	54	106	...	1794
II....	215	67	320	99	111	198	318	37	13	44	68	127	1617
III....	82	14	119	18	47	85	92	18	7	3	25	38	548
IV....	42	6	67	9	23	66	48	12	4	5	15	...	297
V....	...	...	...	11	...	...	...	...	..	...	...	...	11
	605	179	884	231	305	645	764	133	36	106	214	165	4267
							Colonial Surveyors........						6
							TOTAL....................						4273

For graduate students, see p. 223

SECTION XVIII. THE ENGINEERING ALUMNI ASSOCIATION

This calendar presents in outline the courses offered in the Faculty of Applied Science and Engineering, as well as an indication of opportunities which are open to undergraduates for a broadening of their interests by participation in the extra-curricular activities of the Faculty and University.

After spending a few years under the stimulating and maturing influence of college life it is natural that students should, after graduation, feel a desire to preserve the friendships formed in undergraduate days, and should seek to extend the opportunity for further interest and service on behalf of Faculty and Alma Mater.

Many Engineering graduates, who recall their college days with pleasure and a sense of indebtedness, have felt this desire which has found expression in the formation of the Engineering Alumni Association. With succeeding years of mellowing traditions and fresh infusions of new members annually, it has grown in enthusiasm as well as in size. Each graduating class appoints its own permanent executive, thus retaining its identity and through the inspiration and leadership of the Engineering Alumni Association all find a common bond of loyalty to "School" and its traditions, and a friendly contact with their fellows.

Every three years a reunion of "School" graduates is held to bring them together for a renewal of old associations with classmates and with staff. Between times the Association carries on its work through its Council. The extent of these activities is well exemplified by naming such council committees as Membership, Scholarship, Class Organizations, Undergraduate Relations, Engineering Education, Reunions, Publicity, and Federation Affairs. Certain members of the Council are constituted as a Junior Panel and maintain close relations with the more recent graduates, while the inclusion of the President of the Engineering Society on the Council ensures liaison with the undergraduate body.

The Engineering Alumni Association serves in the wider sphere of University graduate activities through its membership in the Alumni Federation of the University of Toronto, which was formed from seventeen associations representing various Colleges, Faculties, and Departments in the University. The Federation co-ordinates the activity of all the Associations and edits and publishes the *University of Toronto Monthly*, which contains news items and articles of interest to all graduates. Through Class, Association and Federation the bond is complete and "School" men take pride in the extent to which they have contributed of their counsel and support on such matters as the University and the Faculty may wish to consult the graduate body.

All "School" graduates, and students who have had at least one year in the Faculty of Applied Science and Engineering, are members of the

Engineering Alumni Association and the Alumni Federation; but only those paying the prescribed annual fee of three dollars are entitled to vote, hold office, or exercise the rights and privileges of membership and to receive the *University of Toronto Monthly.* This fee is distributed—one dollar to the Engineering Alumni Association for the maintenance of its activities, and two dollars to the Alumni Federation towards a share of its administrative expenses and for clerical work on behalf of the Association, and to cover the members' subscription to the *University of Toronto Monthly.*

APPENDIX I. GRADUATE STUDIES

Graduates interested in pursuing courses for post-graduate degrees should send inquiries to the Secretary of the School of Graduate Studies.

The University is prepared to offer graduate courses in all of the Departments of the Faculty of Applied Science and Engineering. The degrees offered are M.A.Sc., M.Arch., and Ph.D. These courses are open to graduates of this University or of another University of comparable standing. Candidates must have a sufficiently good undergraduate record in a course closely related to the one they propose to follow.

Various Fellowships, Bursaries, and Scholarships are available to graduate students as shown in the table on page 161. In time of peace many part-time demonstratorships are open which permit graduate work towards a degree. In normal times, also, research assistants are appointed annually on salary in the School of Engineering Research, and this work may be counted as a partial fulfilment of the requirements for a graduate degree.

One full academic year of study is required for the degree of M.A.Sc. and M.Arch. and a minimum of three years for the degree of Ph.D. Part-time work must total to these full-time requirements. To be eligible to receive the degree of Ph.D. the candidate must make an original contribution to knowledge.

REGULATIONS FOR DEGREES

MASTER OF APPLIED SCIENCE, MASTER OF ARCHITECTURE

The regulations governing the Degrees of Master of Applied Science (M.A.Sc.) and Master of Architecture (M.Arch.) shall be determined as follows:

1*a*. A candidate for the degree of Master of Applied Science shall hold the degree of Bachelor of Applied Science of this University or a degree from some other university recognized as equivalent by the Council of the School of Graduate Studies.

1*b*. A candidate for the degree of Master of Architecture shall hold the degree of Bachelor of Architecture or the degree of Bachelor of Applied Science in Architecture of this University or a degree from some other university recognized as equivalent by the Council of the School of Graduate Studies.

2. A candidate wishing to proceed to a graduate degree shall (*a*) register with the Secretary of the School of Graduate Studies at the beginning of the academic year, (*b*) enrol in one of the courses mentioned in Clause 4. As a condition of registration as a candidate proceeding to a degree, he must submit evidence that the department concerned is willing to enrol him.

3. Not later than November 1, 1947, he shall submit to the Secretary

for acceptance by the Council of the School of Graduate Studies the title of his proposed thesis as approved by the department concerned.

4. Not later than May 15, 1948, he shall present evidence to the Council of the School of Graduate Studies that he has spent not less than one academic year in the course concerned as a student enrolled in one of the following courses on a course of study approved by the department: Civil Engineering, Mining Engineering, Mechanical Engineering, Architecture, Engineering Physics, Chemical Engineering, Electrical Engineering, Metallurgical Engineering, Mining Geology, Aeronautical Engineering.

5. Not later than May 15, 1948, evidence that the candidate has satisfactorily met all the requirements of the department with regard to thesis and to such examinations as the department shall require, shall be forwarded to the Council of the School of Graduate Studies through the sub-committee administering the regulations governing the degrees of Master of Applied Science and Master of Architecture.

DOCTOR OF PHILOSOPHY

Graduates of the Faculty of Applied Science and Engineering may proceed to the degree of Doctor of Philosophy. Information as to the conditions to be met by candidates for this degree is to be found in the Calendar of the School of Graduate Studies, which may be obtained from the Registrar of the University. The degree is an academic degree, not a professional one, and the research work and courses leading to the degree are primarily concerned with the fundamentals and underlying principles of the sciences. In general, a candidate selects one major and two minor subjects for study, the research being carried out in the major subject. A period of three years is usually required for the fulfilment of the requirements for the degree. However, it should be understood that the degree is not granted for the passing of prescribed courses or for the performance of prescribed laboratory work for a period of three years. The laboratory research work must have led to results of a high order, constituting a real contribution to the science of the major subject, and the candidate must have attained a decided maturity of knowledge and outlook before he may present himself for final examination by the Committee of the School of Graduate Studies. A graduate proposing to proceed to this degree should consult, in the first instance, with the members of the staff in the department in which he proposes to take his major subject.

PROFESSIONAL DEGREES

CIVIL ENGINEER, MINING ENGINEER, MECHANICAL ENGINEER, ELECTRICAL ENGINEER, CHEMICAL ENGINEER, METALLURGICAL ENGINEER

The regulations governing the Professional Degrees of Civil Engineer (C.E.), Mining Engineer (M.E.), Mechanical Engineer (Mech.E.), Elec-

trical Engineer (E.E.), Chemical Engineer (Chem.E.), Metallurgical Engineer (Met.E.), for the session 1947-48 shall be determined as follows:

1. A candidate for one of the said degrees shall hold the diploma of the School of Practical Science or of the Faculty of Applied Science and Engineering or the degree of Bachelor of Applied Science, or shall have spent not less than two years as a member of the teaching staff in this Faculty after having graduated in engineering from another institution of recognized reputation.

2. He shall have spent at least three years after receiving the diploma or the degree in the actual practice of the branch of engineering wherein he is a candidate for a degree.

3. Intervals of non-employment, or of employment in other branches of engineering, shall not be included in the above three years. It shall not be necessary that the several periods requisite to make up the said three years be consecutive.

4. The candidate shall obtain from the Secretary of the School of Graduate Studies the regular application form which, properly filled out, accompanied by the designated evidence of professional experience and by the title and synopsis of the proposed thesis, shall be delivered to the Secretary not later than the first day of November.

The evidence of professional experience shall fully describe the kind and extent of all work undertaken by the candidate since the date of graduation up to the time of application, indicating clearly the degree of responsibility for such work. Certificates from present and past employers shall accompany the application. The names and addresses of not less than five engineers to whom the candidate is personally known and who have knowledge of his professional activities shall be submitted.

5. The application and the subject of the thesis are subject to the approval of the Board of Examiners, who may satisfy themselves by oral or written examinations in regard to the candidate's experience and competence in engineering works.

6. The candidate after notification of the approval of the Board shall prepare an original engineering thesis in the branch in which he has applied for a degree. This thesis shall be on work in which the candidate has had actual experience and shall preferably be in the form of an engineer's report on the design of engineering works, or on processes, and accompanied by all necessary descriptions, details, drawings, bills of materials, specifications and estimates. (Note that a thesis of a solely descriptive type will not be acceptable.)

7. The thesis, with accompanying papers, described in clause 6, shall be sent to the Secretary not later than the first day of March.

8. The candidate may be required to present himself for examination in the months of March or April at such time as may be arranged by the Examiners.

9. The thesis, drawings and other papers submitted under clause 7, shall become the property of the University.

10. Nothing in these regulations shall prevent any candidate from receiving more than one of the said degrees, provided he has the necessary qualifications for each degree. An interval of three years must elapse between the granting of any two degrees under these regulations.

HIGH SCHOOL ASSISTANTS' CERTIFICATES, TYPES A AND B

The Department of Education of Ontario has agreed to accept the degree of Bachelor of Applied Science as fulfilling the academic requirement for admission to the course for a High School Assistants' Certificate in the Ontario College of Education.

HIGH SCHOOL ASSISTANTS' CERTIFICATES, TYPE A

By an agreement between the University of Toronto and the Department of Education of Ontario, persons holding the degree of Bachelor of Applied Science may, by taking certain prescribed courses in the Faculty of Arts, complete the academic requirements for admission to the qualifying examination for courses leading to High School Assistants' Certificates, Type A, in (*a*) Mathematics and Physics and (*b*) Science, at the Ontario College of Education. Information regarding these prescribed courses may be obtained from a pamphlet issued by the Registrar of the University, from whom copies may be had on application. Each person who desires to complete these academic requirements should communicate directly with the Registrar in order that his case may be considered and his particular conditions defined.

The Department of Education has approved of the acceptance of the degree in Applied Science in the Course in Engineering Physics, with standing of at least 66% at the final examination, as covering the academic requirements for admission to the qualifying examination for the course leading to High School Assistants' Certificates, Type A, in Mathematics and Physics at the Ontario College of Education.

ONTARIO LAND SURVEYORS AND DOMINION LAND SURVEYORS

Examinations are held usually in February of each year, for the following:

Preliminary Dominion Land Surveyors
Leveller's Examination
Final Dominion Land Surveyors
Ontario Land Surveyors

Any student of the Faculty of Applied Science and Engineering is eligible for these examinations, but graduates in Civil and Mining Engineering are allowed a shortened apprenticeship before writing their final examinations. Full information respecting above examinations may be obtained from the staff in Surveying and Geodesy.

GRADUATES ENROLLED IN THE FACULTY OF APPLIED SCIENCE AND ENGINEERING

Civil Engineering	10
Mechanical Engineering	19
Architecture	2
Engineering Physics	11
Chemical Engineering	12
Electrical Engineering	21
Metallurgical Engineering	6
Mining Geology	3
Aeronautical Engineering	1
Total	85

INDEX

Administrative Officers 7
Admission, Qualifications and Procedure for 24
Advisory Bureau 214
Aerodynamic Laboratory 195
Aeronautical Engineering 31, 76, 82
Ajax Division Libraries 183
Alternating Current Machine Laboratory 191
Alumni Association 217
Annual Examinations 156
Applied Mathematics 139
Applied Mechanics 84
Applied Physics 90
Applied Physics Laboratories 193
Architecture 93
Architecture, School of 31, 47
Assaying 100
Assaying Laboratory 185
Astronomy 103
Athletic Association 207, 210
Attendance, Summary of Students in 217, 224

Bachelor Degrees 31
Botany 104
Bursaries 158
Business Administration 113

Calendar 5
Canadian Officers' Training Corps 213
Cement Laboratory 184
Ceramics and Non-Metallic Minerals 141
Ceramic Engineering 31, 69
Chemical Engineering 31, 58, 105
Chemical Engineering Laboratories 190
Chemistry 105
Civil Engineering 31, 35, 104
Civil Engineering Laboratories 184
Commencement 6
Communication Laboratory 191
Communication 53, 55
Conduct of Students 198
Constitution, Student Societies 207
Courses 31
Courses, Graduating 31, 34
Curriculum 34

Degrees 31
- Bachelor 31
- Master 31, 220
- Professional 31, 221
- Ph.D 31, 221

Departmental Libraries 183
Department of Health Laboratory 195
Deposits 28
Descriptive Geometry 109
Design of Structures 84

Direct Current Machine Laboratory.............................. 191
Discipline.. 198
Dominion Land Surveyors....................................... 223
Drawing... 109

Economics... 113
Electrical Engineering.....................................31, 62
Electrical Engineering Laboratories........................... 190
Electrical Measurements Laboratory............................ 191
Electricity... 117
Electricity and Communication..............................53, 55
Electrochemical Laboratories.................................. 195
Engineering Alumni Association................................ 218
Engineering and Business...................................31, 79
Engineering Problems and Drawing.............................. 109
Engineering Physics..31, 51
Engineering Research, School of............................... 33
Engineering Society... 209
English... 144
Examinations.. 156
Excursions.. 35
Ex-Service Personnel......................................157, 214

Fees.. 28
Fluid Mechanics... 130

Geodesy... 103
Geological Laboratories....................................... 196
Geology... 124
Geological Sciences.......................................124, 143
Geophysics...53, 56
German.. 144
Graduate Studies.. 220
Graduating Courses...31, 34

Hart House.. 204
Hart House—Ajax... 205
Heat Engine Laboratory.. 187
Heat Engines.. 127
High School Assistants' Certificates.......................... 223
Highway Laboratory.. 184
Historical Sketch... 23
Holidays.. 5
Hydraulic Laboratory.. 188
Hydraulics.. 130

Illumination and Acoustics.................................53, 57
Inquiries..24, 33

Laboratories.. 184
Languages... 144
Law... 113
Lecture and Laboratory Subjects............................... 82
Libraries... 183
Loan Funds.. 158
Lodging and Board... 215

Machinery.......... 132
Masters Degrees.......... 220
Mathematics..........136, 139
Mechanical Engineering..........31, 44
Mechanical Engineering Laboratories.......... 187
Mechanics.......... 84
Mechanics of Materials Laboratory.......... 184
Meetings, Engineering Society.......... 5
Medals.......... 158
Metallurgy.......... 139
Metallurgical Engineering..........31, 66
Metallurgical Engineering Laboratories.......... 192
Metrological Laboratory.......... 194
Mineralogical Laboratories.......... 196
Mineralogy.......... 143
Mining.......... 100
Mining Engineering..........31, 40
Mining Geology..........31, 72
Mining Engineering Laboratories.......... 185
Modern Languages.......... 144
Municipal Engineering.......... 104
Museum, Royal Ontario.......... 197

Naval Training Division, University.......... 211
Non-Metallic Minerals.......... 141

Officers, Administrative.......... 7
Officers' Training Corps, Canadian.......... 213
Ontario Department of Health Laboratory.......... 195
Ontario Land Surveyors.......... 223
Ore Dressing.......... 100
Ore Dressing Laboratory.......... 186

Petrography.......... 143
Ph.D..........31, 221
Photographic Laboratory.......... 193
Physical Training..........26, 145, 203
Physics, Applied.......... 90
Physics.......... 145
Practical Experience.......... 149
Professional Degrees..........32, 221
Prizes.......... 158

Refrigeration..........54, 57
Registration..........24, 26
Research Assistants.......... 33
Research, School of Engineering.......... 33
Residences.......... 215
Residences, Ajax.......... 212, 216

Sanitary Engineering Laboratory.......... 194
School of Architecture..........31, 47
School of Engineering Research.......... 33
School of Graduate Studies.......... 220
Scholarships.......... 158
Shop Work..........44, 150

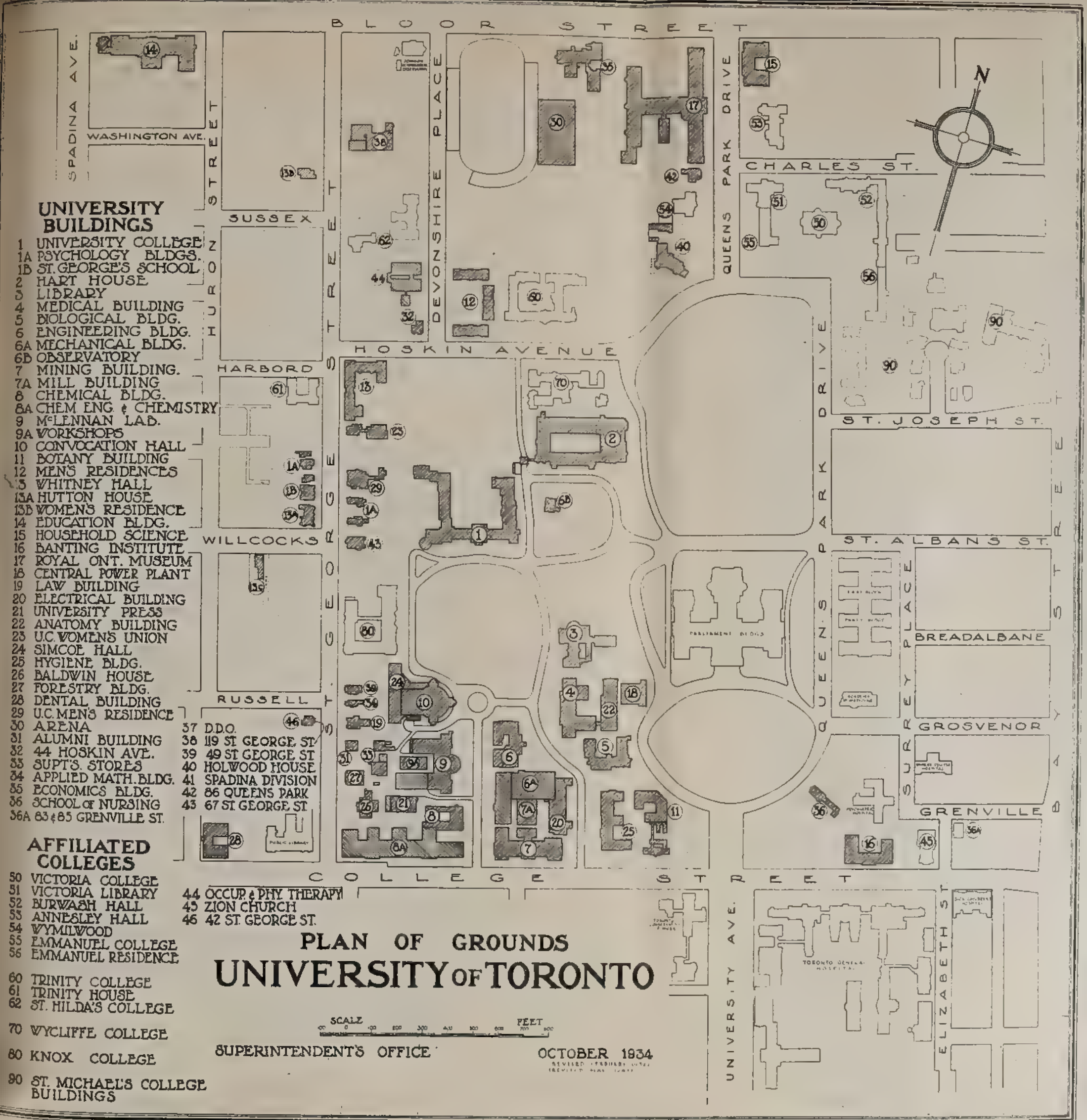
Sickness.......... 156
Soil Mechanics Laboratory.......... 184
Soldiers' Tower.......... 205
Specialists' Certificates.......... 223
Spectroscopy..........53, 55
Staff, Teaching.......... 8
Structures, Design of.......... 84
Student Christian Movement.......... 210
Students' Administrative Council.......... 207
Student Organizations.......... 207
Supplemental Examinations.......... 157
Summary of Students in Attendance..........217, 224
Surveying.......... 151
Survey Camp..........5, 153, 194

Teachers' Certificates.......... 223
Term Examinations.......... 157
Theatre, Hart House.......... 205
Thesis.......... 153

University Health Service.......... 200
University Naval Training Division.......... 212
University Survey Camp.......... 194

Vaccination.......... 26
Varsity Christian Fellowship.......... 211

X-Rays and Spectroscopy..........49, 51


BLOOR STREET
SPADINA AVE.
WASHINGTON AVE.
HURON STREET
SUSSEX
HARBORD
WILLCOCKS
RUSSELL
ST. GEORGE STREET
DEVONSHIRE PLACE
HOSKIN AVENUE
QUEENS PARK DRIVE
CHARLES ST.
ST. JOSEPH ST.
ST. ALBANS ST.
BREADALBANE
GROSVENOR
GRENVILLE
SURREY PLACE
BAY STREET
COLLEGE STREET
UNIVERSITY AVE.
ELIZABETH ST.
N
PARLIAMENT BLDGS.
TORONTO GENERAL HOSPITAL
UNIVERSITY BUILDINGS
1 UNIVERSITY COLLEGE
1A PSYCHOLOGY BLDGS.
1B ST. GEORGE'S SCHOOL
2 HART HOUSE
3 LIBRARY
4 MEDICAL BUILDING
5 BIOLOGICAL BLDG.
6 ENGINEERING BLDG.
6A MECHANICAL BLDG.
6B OBSERVATORY
7 MINING BUILDING.
7A MILL BUILDING
8 CHEMICAL BLDG.
8A CHEM ENG. & CHEMISTRY
9 McLENNAN LAB.
9A WORKSHOPS
10 CONVOCATION HALL
11 BOTANY BUILDING
12 MEN'S RESIDENCES
13 WHITNEY HALL
13A HUTTON HOUSE
13B WOMEN'S RESIDENCE
14 EDUCATION BLDG.
15 HOUSEHOLD SCIENCE
16 BANTING INSTITUTE
17 ROYAL ONT. MUSEUM
18 CENTRAL POWER PLANT
19 LAW BUILDING
20 ELECTRICAL BUILDING
21 UNIVERSITY PRESS
22 ANATOMY BUILDING
23 U.C. WOMEN'S UNION
24 SIMCOE HALL
25 HYGIENE BLDG.
26 BALDWIN HOUSE
27 FORESTRY BLDG.
28 DENTAL BUILDING
29 U.C. MEN'S RESIDENCE
30 ARENA
31 ALUMNI BUILDING
32 44 HOSKIN AVE.
33 SUPT'S. STORES
34 APPLIED MATH. BLDG.
35 ECONOMICS BLDG.
36 SCHOOL OF NURSING
36A 83 & 85 GRENVILLE ST.
37 D.D.O.
38 119 ST. GEORGE ST.
39 49 ST. GEORGE ST.
40 HOLWOOD HOUSE
41 SPADINA DIVISION
42 86 QUEENS PARK
43 67 ST. GEORGE ST.
44 OCCUP. & PHY. THERAPY
45 ZION CHURCH
46 42 ST. GEORGE ST.
AFFILIATED COLLEGES
50 VICTORIA COLLEGE
51 VICTORIA LIBRARY
52 BURWASH HALL
53 ANNESLEY HALL
54 WYMILWOOD
55 EMMANUEL COLLEGE
56 EMMANUEL RESIDENCE
60 TRINITY COLLEGE
61 TRINITY HOUSE
62 ST. HILDA'S COLLEGE
70 WYCLIFFE COLLEGE
80 KNOX COLLEGE
90 ST. MICHAEL'S COLLEGE BUILDINGS
PLAN OF GROUNDS
UNIVERSITY OF TORONTO
SCALE
FEET
SUPERINTENDENT'S OFFICE
OCTOBER 1934

UNIVERSITY OF TORONTO

CALENDAR

Faculty of Applied Science and Engineering

1948-1949

THE UNIVERSITY OF TORONTO PRESS

CONTENTS

		Foreword	3
SECTION	I.	Calendar	5
"	II.	Administrative Officers	7
"	III.	Teaching Staff	8
"	IV.	Historical Sketch	25
"	V.	Admission and Registration	26
"	VI.	Fees, Deposits and Expenses	30
"	VII.	Courses and Degrees	33
"	VIII.	School of Engineering Research	35
"	IX.	Curriculum	36
"	X.	Examinations	158
"	XI.	Scholarships	160
"	XII.	Libraries and Laboratories	191
"	XIII.	Discipline	204
"	XIV.	University Health Service and Physical Education	206
"	XV.	Hart House	212
"	XVI.	Student Organizations	215
"	XVII.	Lodging and Board	223
"	XVIII.	Engineering Alumni Association	226
		Appendix I—Graduate Studies	228
		Index	233

FOREWORD

During the summer of 1945, the University was faced with the difficult problem of providing accommodation for almost double the number of students that had been registered in the previous year. Through the efforts of the Chairman of the Board of Governors, and the President, the University leased from the Crown, part of the huge shell-filling plant at Ajax, twenty-five miles east of Toronto, to relieve the heavy demand for space at Queen's Park. Because it became evident, at an early stage, that a relatively large number of students would register in the Faculty of Applied Science and Engineering, it was decided that the work of the First and Second Years of this Faculty should be given at Ajax.

A special First Year session with approximately 1400 students commenced at Ajax on January 14, 1946. In the regular 1946-47 session both First and Second Year instruction, except Second Year in Architecture, was given at Ajax with 1800 registered in First Year and 1500 in Second Year. In the 1947-48 Session both First and Second Year instruction, except Second Year Architecture was given at Ajax with 1200 registered in First Year and 1400 in Second Year. For the session 1948-49 First and Second Year instruction, except Architecture, will be given at Ajax. All other instruction will be given in Toronto.

To provide for this self-contained University community at Ajax, there are 446 acres and 111 buildings. The University operates such services as: central heating, road maintenance, water supply, sewage disposal, fire department, transportation, post office, laundry, private hospital, cafeteria, tuck shop and barber shop. Former production-line buildings were altered to accommodate 37 lecture rooms, 20 draughting rooms and 14 laboratories. In the 1946-47 session, 2300 students were in residence occupying 32 buildings and in 1947-48 there were 1800 students occupying 26 buildings. Student life at Ajax compares favourably with that in Toronto, excellent accommodation being provided for the following: a general circulating library, a technical library, Hart House Ajax, the Athletic Association, the Health Service, Students' Administrative Council, Advisory Bureau for Ex-Service Students, and a small chapel.

1948 CALENDAR 1948

JANUARY

Sun.	..	4	11	18	25
Mon.	..	5	12	19	26
Tues.	..	6	13	20	27
Wed.	..	7	14	21	28
Thur.	1	8	15	22	29
Fri.	2	9	16	23	30
Sat.	3	10	17	24	31

FEBRUARY

Sun.	1	8	15	22	29
Mon.	2	9	16	23	....
Tues.	3	10	17	24	....
Wed.	4	11	18	25	....
Thur.	5	12	19	26	....
Fri.	6	13	20	27	....
Sat.	7	14	21	28	....

MARCH

Sun.	..	7	14	21	28
Mon.	1	8	15	22	29
Tues.	2	9	16	23	30
Wed.	3	10	17	24	31
Thur.	4	11	18	25	....
Fri.	5	12	19	26	....
Sat.	6	13	20	27	....

APRIL

Sun.	..	4	11	18	25
Mon.	..	5	12	19	26
Tues.	..	6	13	20	27
Wed.	..	7	14	21	28
Thur.	1	8	15	22	29
Fri.	2	9	16	23	30
Sat.	3	10	17	24	....

MAY

Sun.		2	9	16	23	30
Mon.		3	10	17	24	31
Tues.		4	11	18	25	....
Wed.		5	12	19	26	....
Thur.		6	13	20	27	....
Fri.		7	14	21	28	....
Sat.	1	8	15	22	29	....

JUNE

Sun.	..	6	13	20	27
Mon.	..	7	14	21	28
Tues.	1	8	15	22	29
Wed.	2	9	16	23	30
Thur.	3	10	17	24	....
Fri.	4	11	18	25	....
Sat.	5	12	19	26	....

JULY

Sun.	..	4	11	18	25
Mon.	..	5	12	19	26
Tues.	..	6	13	20	27
Wed.	..	7	14	21	28
Thur.	1	8	15	22	29
Fri.	2	9	16	23	30
Sat.	3	10	17	24	31

AUGUST

Sun.	1	8	15	22	29
Mon.	2	9	16	23	30
Tues.	3	10	17	24	31
Wed.	4	11	18	25	....
Thur.	5	12	19	26	....
Fri.	6	13	20	27	....
Sat.	7	14	21	28	....

SEPTEMBER

Sun.	..	5	12	19	26
Mon.	..	6	13	20	27
Tues.	..	7	14	21	28
Wed.	1	8	15	22	29
Thur.	2	9	16	23	30
Fri.	3	10	17	24	....
Sat.	4	11	18	25	....

OCTOBER

Sun.		3	10	17	24	31
Mon.		4	11	18	25	....
Tues.		5	12	19	26	....
Wed.		6	13	20	27	....
Thur.		7	14	21	28	....
Fri.	1	8	15	22	29	....
Sat.	2	9	16	23	30	....

NOVEMBER

Sun.	..	7	14	21	28
Mon.	1	8	15	22	29
Tues.	2	9	16	23	30
Wed.	3	10	17	24	....
Thur.	4	11	18	25	....
Fri.	5	12	19	26	....
Sat.	6	13	20	27	....

DECEMBER

Sun.	..	5	12	19	26
Mon.	..	6	13	20	27
Tues.	..	7	14	21	28
Wed.	1	8	15	22	29
Thur.	2	9	16	23	30
Fri.	3	10	17	24	31
Sat.	4	11	18	25	....

1949 CALENDAR 1949

JANUARY

Sun.		2	9	16	23	30
Mon.		3	10	17	24	31
Tues.		4	11	18	25	....
Wed.		5	12	19	26	....
Thur.		6	13	20	27	....
Fri.		7	14	21	28	....
Sat.	1	8	15	22	29	....

FEBRUARY

Sun.	..	6	13	20	27
Mon.	..	7	14	21	28
Tues.	1	8	15	22	....
Wed.	2	9	16	23	....
Thur.	3	10	17	24	....
Fri.	4	11	18	25	....
Sat.	5	12	19	26	....

MARCH

Sun.	..	6	13	20	27
Mon.	..	7	14	21	28
Tues.	1	8	15	22	29
Wed.	2	9	16	23	30
Thur.	3	10	17	24	31
Fri.	4	11	18	25	....
Sat.	5	12	19	26	....

APRIL

Sun.	..	3	10	17	24
Mon.	..	4	11	18	25
Tues.	..	5	12	19	26
Wed.	..	6	13	20	27
Thur.	..	7	14	21	28
Fri.	1	8	15	22	29
Sat.	2	9	16	23	30

MAY

Sun.	1	8	15	22	29
Mon.	2	9	16	23	30
Tues.	3	10	17	24	31
Wed.	4	11	18	25	....
Thur.	5	12	19	26	....
Fri.	6	13	20	27	....
Sat.	7	14	21	28	....

JUNE

Sun.	..	5	12	19	26
Mon.	..	6	13	20	27
Tues.	..	7	14	21	28
Wed.	1	8	15	22	29
Thur.	2	9	16	23	30
Fri.	3	10	17	24	....
Sat.	4	11	18	25	....

JULY

Sun.		3	10	17	24	31
Mon.		4	11	18	25	....
Tues.		5	12	19	26	....
Wed.		6	13	20	27	....
Thur.		7	14	21	28	....
Fri.	1	8	15	22	29	....
Sat.	2	9	16	23	30	....

AUGUST

Sun.	..	7	14	21	28
Mon.	1	8	15	22	29
Tues.	2	9	16	23	30
Wed.	3	10	17	24	31
Thur.	4	11	18	25	....
Fri.	5	12	19	26	....
Sat.	6	13	20	27	....

SEPTEMBER

Sun.	..	4	11	18	25
Mon.	..	5	12	19	26
Tues.	..	6	13	20	27
Wed.	..	7	14	21	28
Thur.	1	8	15	22	29
Fri.	2	9	16	23	30
Sat.	3	10	17	24	....

OCTOBER

Sun.		2	9	16	23	30
Mon.		3	10	17	24	31
Tues.		4	11	18	25	....
Wed.		5	12	19	26	....
Thur.		6	13	20	27	....
Fri.		7	14	21	28	....
Sat.	1	8	15	22	29	....

NOVEMBER

Sun.	..	6	13	20	27
Mon.	..	7	14	21	28
Tues.	1	8	15	22	29
Wed.	2	9	16	23	30
Thur.	3	10	17	24	....
Fri.	4	11	18	25	....
Sat.	5	12	19	26	....

DECEMBER

Sun.	..	4	11	18	25
Mon.	..	5	12	19	26
Tues.	..	6	13	20	27
Wed.	..	7	14	21	28
Thur.	1	8	15	22	29
Fri.	2	9	16	23	30
Sat.	3	10	17	24	31

SECTION I. CALENDAR 1948-1949

FALL TERM 1948

May 1 Sat......Students of the III Year, Courses 1, 2 and 9, report at Survey Camp (Course 1 at Ajax, Courses 2 and 9 at Gull Lake).

July 1 Thur.....Dominion Day. Buildings closed.

July 15 Thur.....Last day for receiving applications for Supplemental Examinations.

Aug. 21 Sat......Students of the III Year, Courses 1, 2 and 9, report at Survey Camp (Course 1 at Dorset, Courses 2 and 9 at Gull Lake).

Aug. 30 Mon.....Supplemental Examinations commence. All written Supplementals will be held in Toronto except for students entering II Year, Course 6, who will write at Ajax.

Sept. 1 Wed.....Last day for receiving applications for admission to the I Year. Students in II Year, Course 6, report at Ajax for Chemical Laboratory.

Sept. 6 Mon.....Labour Day. Buildings closed.

Sept. 13 Mon.....Special meeting of Faculty Council.

Sept. 16-18 Thur.-Sat...Registration in person of the I Year from 9.30 a.m. to 12 noon and from 2.00 p.m. to 4.30 p.m., (Saturday 9.30 a.m. to 12.00 noon) at Ajax and Toronto.

Sept. 20 Mon.....Registration in person of the III Year (except Architecture) from 9.30 a.m. to 12.00 noon, and 2.00 p.m. to 4.30 p.m. at the Mining Building, Toronto.

Students in Architecture of the III, and IV Years report at the Sketching Camp at Dorset.

Sept. 20-21 Mon.-Tues..Registration in person of the II Year (except Architecture) from 9.30 a.m. to 12.00 noon, and 2.00 p.m. to 4.30 p.m. at Ajax.

Sept. 21 Tues.....Registration in person of the IV Year (except Architecture) and II and V Years Architecture from 9.30 a.m. to 12.00 noon, and 2.00 p.m. to 4.30 p.m., at the Mining Building, Toronto.

Dean's address to the I Year at Ajax.

Preliminary instruction to the I Year at Ajax.

Sept. 22 Wed.....Lectures and laboratory work commence at 9.00 a.m. The opening address by the President to the Toronto students of all Faculties at 3.45 p.m., in Convocation Hall.

Sept. 28 Tues.....Meeting of Faculty Council.

Sept. 29 Wed.....Registration in person, at the Faculty Office, of III and IV Years in Architecture, from 9.30 a.m., to 12 noon.

Sept. 30 Thur.....The opening address by the President to the Ajax students at 3.45 p.m. in the Recreation Hall, Ajax.
Oct. 4 Mon.....Meeting of the Faculty Council.
Oct. 8 Fri......Meeting of Senate.
Oct. 9 Sat......Meeting of Caput.
*Oct. 11 Mon.....Thanksgiving Day. Buildings closed.
Oct. 12 Tues.....Meeting of Engineering Society.
Nov. 3 Wed.....Meeting of Faculty Council.
Nov. 11 Thur ....Remembrance Day Service at the Soldiers' Tower, Toronto, and at the Recreation Hall, Ajax, at 10.45 a.m. Neither lectures nor laboratory classes given from 10.00 a.m. to 11.15 a.m.
Meeting of Engineering Society.
Nov. 12 Fri......Fall Convocation and meeting of the Senate.
Dec. 2 Thur.....Meeting of Faculty Council.
Dec. 8 Wed.....Meeting of Engineering Society.
Dec. 10 Fri......Meeting of Senate.
Dec. 13 Mon.....I Year Term Examinations commence.
Dec. 17 Fri......Term ends at 5.00 p.m.

SPRING TERM 1949

Jan. 1 Sat......Buildings closed.
Jan. 3 Mon.....Spring Term begins.
Mid-session Examinations commence.
Jan. 10 Mon.....Meeting of Faculty Council.
Jan. 14 Fri......Meeting of Senate.
Jan. 15 Sat......Last day for receiving the second term instalment of fees
Jan. 18 Tues.....Meeting of Engineering Society.
Feb. 1 Tues.....Meeting of Faculty Council.
Feb. 10 Thur.....Meeting of Engineering Society.
Feb. 11 Fri......Meeting of Senate.
Feb. 23 Wed.....Meeting of Engineering Society (nominations).
Feb. 25 Fri......Engineering Society Annual Elections.
Feb. 28 Mon.....Engineering Society Annual General Meeting.
Mar. 2 Wed.....Meeting of Faculty Council.
Mar. 11 Fri.......Meeting of Senate.
Mar. 26 Sat......Term ends at 12.00 noon.
Apr. 1 Fri......Meeting of Faculty Council.
Apr. 4 Mon.....Annual Examinations commence.
Apr. 8 Fri......Meeting of Senate.
Apr. 15 Fri......Good Friday.
May 3 Tues.....Meeting of Faculty Council.
May 13 Fri......Meeting of Senate.
May 30 Mon.....Meeting of Senate.
June 2-3 Thur.-Fri.....University Commencement.

*Or such other date as may be determined by Order-in-Council.

SECTION II. ADMINISTRATIVE OFFICERS

THE UNIVERSITY

President . . . . . Sidney Smith, K.C., M.A., LL.B., LL.D., D.C.L.

Registrar . . . . A. B. Fennell, M.C., M.A.
Librarian . . . . W. S. Wallace, M.A., F.R.S.C.
Warden of Hart House . . . . . . N. Ignatieff, M.B.E., B.SC.
Director of University Extension W. J. Dunlop, B.A., B. PAED., LL.D.

Acting Comptroller . . . . R. E. Spence, B.A., A.C.A.
Bursar and Secretary to the Board of Governors . C. E. Higginbottom
Superintendent of Buildings and Grounds . . A. D. LePan, B.A.SC.
Acting Chief Accountant . . . . G. L. Court, D.F.C., B.COM., C.A.
Director of University Health Service . . C. D. Gossage, O.B.E., M.D., F.R.C.S.
Assistant Director of University Health Service for Women
Miss F. H. Stewart, B.A., M.D.
General Manager of the University of Toronto Press . A. G. Burns, B.A.

THE FACULTY OF APPLIED SCIENCE AND ENGINEERING

Dean . . C. R. Young, B.A.SC., C.E., D.ENG., D. ÈS SC. A., M.E.I.C., M.AM. SOC. C.E.
Assistant Dean and Secretary . . W. S. Wilson, E.D., B.A.SC., M.E.I.C.
Assistant Secretary . . . . Miss E. Birkett
Director of Studies, Ajax. W. J. T. Wright, M.B.E., B.A., B.A.SC., M.E.I.C.
Assistant to Director of Studies, Ajax
H. L. Shepherd, B.A.SC., M.E.I.C.

THE AJAX DIVISION

Dean and Supervisor of Residences . . . . R. H. Perry, M.A.
Deputy Bursar . . . . D. J. Reid
Deputy Superintendent of Buildings and Grounds . . . . . A. Russell
Senior Resident Physician . . . . . . W. F. MacKenzie, M.C., M.D.
Supervisor of Hart House Ajax . . . . D. L. Emond, B.A.
Manager of the Food Service Department . . Miss H. MacIntosh, B.H.SC.
Librarian . . . . Mrs. R. H. Perry, B.A.
Supervisor of Athletics and Recreation . . . . F. E. Horton

SECTION III. TEACHING STAFF

1947-48

PROFESSORES EMERITI

G. R. Anderson, M.A., A.M. (Harv.) 5 duMaurier Blvd.
Professor Emeritus of Engineering Physics and Photography

R. W. Angus, B.A.Sc., M.E., Hon. M.E.I.C., Hon. Mem. A.S.M.E.
Professor Emeritus of Mechanical Engineering Mechanical Bldg.

J. W. Bain, B.A.Sc., F.R.S.C. .... 30 Burton Rd.
Professor Emeritus of Chemical Engineering.

G. A. Guess, M.A. (Qu.) Oakville
Professor Emeritus of Metallurgical Engineering

H. E. T. Haultain, C.E. National Club
Professor Emeritus of Mining Engineering

H. W. Price, M.B.E., B.A.Sc., E.E. .... 40 Ava Road
Professor Emeritus of Electrical Engineering.

DEPARTMENT OF AERONAUTICAL ENGINEERING

T. R. Loudon, V.D., B.A.Sc., M.E.I.C., M.I.Ae.Sc. 189 Sheldrake Blvd.
Professor of Civil Engineering and Aeronautics.

G. N. Patterson, B.A.Sc. (Alta.), M.A., Ph.D., A.F.R.Ae.S.
Professor of Aerodynamics 17 Langmuir Cres.

B. Etkin, M.A.Sc. 57 Hartley Ave.
Lecturer in Aeronautical Engineering.

W. Czerwinski, Dip.Eng. (Politech. Lwow) 3 Claxton Blvd.
Special Lecturer in Aeronautical Engineering.

W. H. Jackson, B.A.Sc. 85 Ridge Hill Dr.
Special Lecturer in Aeronautical Engineering.

W. J. Jakimiuk, M.S. (Wilno), B.A.Sc.Ae. (Paris), M.A.Sc. (Paris)
Special Lecturer in Aeronautical Engineering. 931 Avenue Rd.

B. S. Shenstone, M.A.Sc. 556 St. Clements Ave.
Special Lecturer in Aeronautical Engineering.

E. Fraenkel, B.A.Sc. Wycliffe College
Instructor in Aeronautical Engineering.

I. I. Glass, B.A.Sc. 514 Manning Ave.
Instructor in Aeronautical Engineering.

DEPARTMENT OF APPLIED PHYSICS

K. B. Jackson, B.A.Sc., M.I.E.S. 362 Glengrove Ave. W.
Professor of Applied Physics.

V. L. Henderson, B.A.Sc., A.M. (Mich.), Mem. Acoustical Soc.
Assistant Professor of Applied Physics 397 Glengrove Ave. W.

E. L. Dodington, B.A.Sc. 415 Sutherland Dr.
Lecturer in Applied Physics.

J. J. Klawe, M.A. (Glasgow), Dip.I.E.C. (Grenoble) 11 Maple Ave.
Lecturer in Applied Physics.

J. T. N. Atkinson, B.Eng., M.A.Sc. (McG.), Ph.D. 21 Isabella St.
Special Lecturer in Applied Physics.

S. BROERSMA, B.A., M.A. (Leyden), PH.D. (Delft) — 40 College St.
Instructor in Applied Physics.

L. A. COOK, B.Sc. (Qu.) — Arbor Lodge, Ajax
Instructor in Applied Physics.

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B. D. WOOD, B.A.Sc. — 2006-B Bathurst St.
Special Lecturer in Mechanical Engineering.

T. S. HUGHES — 33 Admiral Rd.
Lecturer in Mechanical Engineering (part time).

W. H. BRYDON, B.A.Sc. — 59 Main St., Brampton
Instructor in Mechanical Engineering.

W. H. CARTER — 91 Walmsley Blvd.
Instructor in Mechanical Engineering.

E. J. DURAND, B.A.Sc. — 68 Castlewood Rd.
Instructor in Mechanical Engineering.

G. G. GILCHRIST, B.A.Sc. — 61 Braemore Gdns.
Instructor in Mechanical Engineering.

J. A. KETOLA, B.A.Sc. — 112 Hannaford Ave.
Instructor in Mechanical Engineering.

J. H. MACLEAN, B.A.Sc. — 74 Shelborne Ave.
Instructor in Mechanical Engineering.

R. F. MARK, B.A.Sc. — 158½ York Street
Instructor in Mechanical Engineering.

F. F. ROBERTS, M.A.Sc. — 124 Bedford Rd.
Instructor in Mechanical Engineering.

G. W. SIMONSON, B.A.Sc. — 304 Huron St.
Instructor in Mechanical Engineering.

W. D. M. BLACK — 136 High Park Ave.
Demonstrator in Mechanical Engineering.

C. E. LYALL, B.A.Sc. — 173 Balmoral Ave.
Demonstrator in Mechanical Engineering.

K. H. Y. MARK, B.A.Sc. — 158½ York Street
Demonstrator in Mechanical Engineering.

F. MOSKAL, DIP.MECH.ENG. (Lond.) — 42 Lindsey Ave.
Demonstrator in Mechanical Engineering.

D. F. QUAN, B.A.Sc. — 175 Dundas St. W.
Demonstrator in Mechanical Engineering.

C. E. SIMMONS, B.A.Sc. — P.O. Box 96, Oshawa
Demonstrator in Mechanical Engineering.

T. R. STEE, B.A.Sc. — 404 Glencairn Ave.
Demonstrator in Mechanical Engineering.

G. H. TUCKER, B.A.Sc. — 143 Bloor St. W.
Demonstrator in Mechanical Engineering.

J. A. Whitten, B.A.Sc. 49 Oakmount Rd.
Demonstrator in Mechanical Engineering.

T. F. Williscroft, B.Sc. (Lond.) 228 Albany Ave.
Demonstrator in Mechanical Engineering.

R. A. Hamilton 56 Maple Ave.
Demonstrator in Mechanical Engineering (part time).

R. C. Parker, B.A.Sc. 36 Millbank Ave·
Demonstrator in Mechanical Enginereing (part time).

C. E. Simmons, B.A.Sc. Box 96, Oshawa
Demonstrator in Mechanical Engineering (part time).

R. B. Telford, B.A.Sc. R.R. 1, York Mills
Demonstrator in Mechanical Engineering (part time).

W. A. Traill, B.A.Sc. 174 Woodmount Ave.
Demonstrator in Mechanical Engineering (part time).

D. R. Yeomans, B.A.Sc. 87 Rivercrest Rd.
Demonstrator in Mechanical Engineering (part time).

DEPARTMENT OF METALLURGICAL ENGINEERING

L. M. Pidgeon, B.Sc. (Ox.), Ph.D. (McG.), F.R.S.C.
Professor of Metallurgical Engineering. 185 Rosedale Heights Dr.

B. Chalmers, D. Phil. (London)
Professor of Metallurgical Engineering

P. M. Corbett, B.S. (Ill.), M.S. (Penn. State) 24 Brock St., Ajax
Associate Professor of Ceramics.

J. E. Toomer, B.Sc. (North Carolina) 707 Eglinton Ave. W.
Assistant Professor of Metallurgical Engineering.

H. U. Ross, M.Sc. (McG.) 49 Rosedale Rd.
Lecturer in Metallurgical Engineering.

B. M. Thall, M.A.Sc. 410 Clinton St.
Lecturer in Metallurgical Engineering.

Miss M. F. Satterly, B.A., M.F.A. (Alfred) 95 Bernard Ave.
Demonstrator in Ceramics

K. Aszt, B.A.Sc. 53 First Ave.
Demonstrator in Metallurgical Engineering.

I. I. Betcherman, B.Sc. (Qu.), M.A.Sc. 83 Corbett Ave.
Demonstrator in Metallurgical Engineering.

DEPARTMENT OF MINING ENGINEERING

C. G. Williams, B.A.Sc. 417 Rosemary Rd.
Professor of Mining Engineering.

R. E. Barrett, B.Sc. (McG.) Mining Bldg.
Professor of Mining Engineering.

S. E. WOLFE, M.A.Sc. — R.R. 1, Streetsville
Associate Professor of Mining Engineering.

M. HEWER, B.A.Sc. — 68 Kingsway Cres.
Assistant Professor of Mining Engineering.

J. Giovanetti, B.A.Sc. — 21 Mansfield Ave.
Instructor in Mining Engineering.

B. J. HAYNES, B.A.Sc. — 29 Falcon St.
Instructor in Mining Engineering.

M. R. MAYNARD, B.A.Sc. — 38 Old Orchard Gr.
Instructor in Mining Engineering.

R. N. PARKINSON, B.A.Sc. — 25 Aylmer Ave.
Instructor in Mining Engineering.

M. D. MCCULLOCH, B.A.Sc. — 302 Maitland St.
Demonstrator in Mining Engineering.

OTHER SPECIAL LECTURERS

R. R. GRANT, O.L.S., F.C.A. — 102 Blythwood Rd.
Special Lecturer in Accountancy and Business

P. H. MILLS, B.A.Sc. — 80 King St. W.
Special Lecturer in Engineering Law.

PROFESSORS OF OTHER FACULTIES GIVING INSTRUCTION TO STUDENTS IN APPLIED SCIENCE

D. S. AINSLIE M.A., PH.D. — 88 Chatsworth Dr.
Associate Professor of Physics.

MISS E. J. ALLIN, M.A., PH.D. — Apt. 35, 8 St. Thomas St.
Assistant Professor of Physics.

D. C. BAILLIE, M.A. — 79 Hilton Ave.
Assistant Professor of Mathematics.

C. BARNES, M.SC. (Leeds), PH.D. — 269 St. Leonards Ave.
Associate Professor of Physics.

F. E. BEAMISH, M.A. (McM.) — 277 Heath St. E.
Professor of Chemistry.

S. BEATTY, M.A., PH.D., F.R.S.C. — 537 Markham St.
Professor of Mathematics.

A. A. BRANT, M.A., PH.D. (Berlin) — 15 Grenadier Heights
Associate Professor of Geophysics.

J. D. BURK, B.A. — 30 Duggan Ave.
Associate Professor of Mathematics.

J. T. BURT-GERRANS, PHM.B., M.A., PH.D. — 46 Dewson St.
Professor of Electrochemistry.

E. F. BURTON, O.B.E., B.A. (Tor.), (Camb.), PH.D., F.R.S.C.
Professor of Physics. — 224 Queen's Drive, Weston

J. Convey, M.Sc. (Alta.), Ph.D. 30 Beaufort Rd.
Associate Professor of Physics.

M. F. Crawford, B.A. (West.), M.A., Ph.D., F.R.S.C.
Associate Professor of Physics. 11 Washington Ave.

A. W. Currie, B.A., B.Com. (Qu.), D.Com.Sc. (Harv.) 5 Berney Cresc.
Assistant Professor of Political Economy.

J. B. Ferguson, B.A., F.R.S.C. 100 Albertus Ave.
Associate Professor of Chemistry.

T. Hedman, Ph.B. (Chic.) 171 Old Forest Hill Rd.
Associate Professor of German.

J. H. Hodgson, B.A. 37 St. Clements Ave.
Assistant Professor of Geophysics.

H. J. C. Ireton, M.A., Ph.D. 76 Lonsdale Rd.
Professor of Physics.

Miss C. C. Krieger, M.A., Ph.D. 173 Walmer Rd.
Assistant Professor of Mathematics.

G. B. Langford, B.A.Sc., Ph.D. (Cor.), F.R.S.C. R.R. No. 1
Professor of Mining Geology Downsview

D. J. Le Roy, M.A., Ph.D., F.R.S.C. 625 Oriole Parkway
Associate Professor of Chemistry.

W. Line, O.B.E., M.A. (Alta.), Ph.D. (Lond.) 34 Burnaby Blvd.
Professor of Psychology.

A. MacLean, B.A. 488 Spadina Ave.
Professor of Geology.

V. B. Meen, M.A., Ph.D. 34 Birchview Blvd.
Assistant Professor of Mineralogy.

A. D. Misener, M.A. Ph.D. (Camb.) 126 Lyndhurst Ave.
Assistant Professor of Physics.

E. S. Moore, M.A., Ph.D. (Chic.), F.R.S.C. 18 Indian Grove
Professor of Geology.

W. W. Moorhouse, M.A., Ph.D. (Col.) 898 Islington Ave., Islington
Assistant Professor of Geology.

M. A. Peacock, A.M. (Harv.), Ph.D., D.Sc. (Glas.), F.R.S.C.
Professor of Crystallography and Mineralogy 81 Moore Ave.

I. R. Pounder, M.A., Ph.D. (Chic.) 19 Glen Gordon Rd.
Professor of Mathematics.

J. Reekie, B.Sc. (Edin.), Ph.D. (Edin. and Camb.) F.R S. (Edin.)
Visiting Assistant Professor of Physics. 24 Maple Ave., Ajax

R. Richmond, M.A., Ph.D. 41 Roslin Ave.
Assistant Professor of Physics.

D. A. F. Robinson, M.A., Ph.D. (Chic.) 592 University Ave.
Associate Professor of Mathematics.

G. de B. Robinson, M.B.E., B.A., Ph.D. (Camb.) F.R.S.C.
Associate Professor of Mathematics. 20 Whitehall Rd.

L. J. Rogers, B.A.Sc., M.A. — 110 Garfield Ave.
Professor of Analytical Chemistry.

L. S. Russell, B.Sc. (Alta.), M.A., Ph.D. (Princ.), F.R.S.C. — 9 Donnybrook Lane, Islington
Assistant Professor of Palaeontology.

J. Satterly, M.A. (Camb.), D.Sc. (London), F.R.S.C. — 95 Bernard Ave.
Professor of Physics.

F. G. Smith, M.Sc. (Man.), Ph.D. — 57 Prince Arthur Ave.
Assistant Professor of Geological Sciences.

A. F. C. Stevenson, M.A., Ph.D. (Camb.), F.R.S.C. — 28 Summerhill Gdns.
Professor of Mathematics.

W. J. Webber, B.A. (Camb.) — 18 Kappele Ave.
Professor of Mathematics.

H. L. Welsh, M.A., Ph.D. — 112 Glencairn Ave.
Assistant Professor of Physics.

F. E. W. Wetmore, B.Sc. (N.B.), M.A., Ph.D. — 53 Bayview Ave.
Associate Professor of Chemistry.

J. T. Wilson, O.B.E., B.A., M.A. (Camb.), Ph.D. (Princ.) — 29 Roxborough St. E.
Professor of Geophysics.

SECTION IV. HISTORICAL SKETCH

The Legislative Assembly of the Province of Ontario during the Session of 1877 gave its sanction to the establishment of a School of Practical Science on the basis proposed in the memorandum of the Minister of Education confirmed by the Lieutenant-Governor in Council on the 3rd day of February, 1877.

By the scheme thus approved the Government effected an arrangement with the Council of University College whereby the instruction given by its professors and lecturers in all departments of science embraced in the work of the School was made available to students of the School. This arrangement was brought to an end in 1889 by the transfer of the departments of science, above referred to, from University College to the University of Toronto under the operation of the University Federation Act. In order that the students of the School might continue to enjoy the advantage of the instruction of the above departments, the Senate of the University of Toronto passed a statute in October, 1889, affiliating the School with the University. The statute was confirmed by the Lieutenant-Governor on the 30th day of October, 1889.

By an Order-in-Council, approved by the Lieutenant-Governor on the 6th day of November, 1889, a Principal was appointed, and the management of the School was entrusted to a council composed of the Principal as chairman, and the Professors, Lecturers, and Demonstrators appointed in the Teaching Faculty of the School.

On December 14th, 1900, the Senate, by statute subsequently approved by the Lieutenant-Governor in Council, established a Faculty of Applied Science and Engineering but without assuming any liability for its support or maintenance. Under this statute the teaching staff and examiners of the School of Practical Science became the teaching staff and examiners of the Faculty, although the University retained the right to appoint the examiners for the Bachelor of Applied Science and professional degrees. By the University Act of 1906 the School of Practical Science became the Faculty of Applied Science and Engineering of the University of Toronto.

On April 8th, 1892, the Senate of the University established the Degree of B.A.Sc., which was open to those who held the Diploma of the School and were prepared to devote a fourth year to advanced work. In the Session of 1909-1910 a new course extending over four years and leading to the Degree of B.A.Sc., came into operation, taking the place of the long established diploma course of three years, which came to an end in the Session 1910-1911. In the session 1923-24 the degree was changed to B. Arch. for the students graduating in Architecture.

SECTION V. ADMISSION AND REGISTRATION

Inquiries about admission to this Faculty should be sent to the Registrar of the University.

CHANGE IN ADMISSION REQUIREMENTS

Commencing with the Session 1950-51, applicants for admission to the Faculty of Applied Science and Engineering will be required to have at least third class honours in each subject of their Grade XIII examination.

GENERAL

1. Candidates for admission in 1948 to the Faculty of Applied Science and Engineering must submit the certificates listed below as evidence that they are qualified to take one of the courses of instruction and proceed to a degree. Applicants must also submit a certificate of good character, and must have completed the seventeenth year of their age. The procedure for application and registration is described in paragraph 8 below.

2. In general, the holding of any of the following classes of certificate will constitute qualification for admission to this Faculty.

(*a*) The Ontario Secondary School Graduation Diploma in either the General Course or the Vocational Course (Industrial Department), and the Ontario Grade XIII certificate as described in paragraph 3 below.

(*b*) Certificates of having passed certain equivalent examinations as described in paragraph 5 below.

(*c*) Certificates of undergraduate work in other universities. See admission to advanced standing, paragraphs 6 and 7 below.

The Senate will consider applications for the recognition of certificates other than those mentioned as occasion may require. Such certificates must be accompanied by an official statement of the marks in the various subjects upon which the certificate was granted.

3. SECONDARY SCHOOL GRADUATION DIPLOMA

No subjects are definitely prescribed, but the diploma must show credit for four optional subjects.

GRADE XIII

ENGLISH
MATHEMATICS (Algebra, Geometry, Trigonometry)
SCIENCE (Chemistry and Physics)
One of FRENCH
GERMAN
GREEK
ITALIAN
LATIN
SPANISH

It is highly desirable that applicants for admission should have a good standing in Mathematics (Algebra, Geometry, Trigonometry).

A candidate applying to enter the course in Engineering Physics must have met the regular requirements for admission to the faculty and, in

addition, have obtained an average of seventy-five per cent. in Mathematics (Algebra, Geometry, and Trigonometry) of the Grade XIII examination. A candidate whose general proficiency record in other subjects is not considered by the Council to be sufficiently high will not be admitted.

A candidate applying to enter the course in Aeronautical Engineering must have met the regular requirements for admission to the Faculty, and, in addition, must have good standing in Mathematics and Science. A candidate whose general proficiency record in other subjects is not considered by the Council to be sufficiently high will not be admitted to the course.

4. Those intending to enter the course in Architecture are recommended to select French as one of the admission subjects; those intending to enter Chemical, Civil, Electrical, Mechanical, Metallurgical Engineering, or Engineering Physics are recommended to select German.

EQUIVALENT CERTIFICATES

5. Certificates of the following examinations recognized as equivalent in value to the Ontario Secondary School Graduation Diploma and Grade XIII certificate may be accepted in so far as they meet the admission requirements of the University of Toronto and conform to the admission requirements of the universities of the respective provinces. A candidate applying for admission on such certificates must submit an official statement of the marks upon which these certificates were awarded.

PROVINCE OF QUEBEC

Quebec High School Leaving and Senior High School Leaving certificates; the Junior and Senior Matriculation certificates of McGill University.

PROVINCE OF NEW BRUNSWICK

Junior and Senior Matriculation certificates.

PROVINCE OF NOVA SCOTIA

High School certificates of Grade XI and Grade XII issued or endorsed by the Department of Education.

PROVINCE OF MANITOBA

The Junior (Grade XI) and Senior (Grade XII) Matriculation certificates.

PROVINCE OF BRITISH COLUMBIA

The University Entrance or Junior Matriculation certificate and the Senior Matriculation certificate.

PROVINCE OF PRINCE EDWARD ISLAND

First Class License certificates issued by the Education Department or Honour Diplomas issued by the Prince of Wales College; Third Year certificates issued by the above College.

PROVINCE OF ALBERTA

The Junior (Grade XI) and Senior (Grade XII) Matriculation certificates.

PROVINCE OF SASKATCHEWAN

The Junior (Grade XI) and Senior (Grade XII) Matriculation certificates.

NEWFOUNDLAND

Junior and Senior Associate diplomas of the Department of Education.

NEWFOUNDLAND AND THE MARITIME PROVINCES

Certificates of the Common Examining Board.

GREAT BRITAIN

Certificate of having passed, or having exemption from the Preliminary Examination of the Institution of Civil Engineers in the British Isles, or equivalent.

ADMISSION TO ADVANCED STANDING

6. An undergraduate of another university may be admitted to advanced standing on such conditions as the Senate, on the recommendation of the Council of the Faculty, may prescribe.

7. An applicant for admission to advanced standing must submit with his application for admission: (1) an official transcript of his record in the University from which he wishes to transfer, showing in detail the courses which he has completed, with his standing in each; (2) certificate of honourable dismissal; (3) calendar of the university giving a full description of these courses.

PROCEDURE FOR APPLICATION AND REGISTRATION

8. Candidates for admission should apply to the Registrar of the University for forms of applications for admission; they are required to fill in these forms in duplicate and return them to the Registrar *not later than* September 1st, together with the following: (*a*) the Ontario Secondary School Graduation Diploma in the General Course and the Ontario Grade XIII certificate; (*b*) any other evidence of ability to take the work proposed; (*c*) certificate of good character. Failure to make early application will result in delay and inconvenience for the candidate.

9. Every person admitted to the University as an undergraduate must, at the time of his or her first medical examination by the University Health Service, present satisfactory evidence of successful vaccination, or must be vaccinated by the examining physician.

10. Every student must register in person with the Secretary of the Faculty as prescribed on page 5 of the Calendar.

11. A student who fails to register as prescribed in clause 10, must petition the Council for permission to register late. The Council, however, reserves the right to refuse the permission, or to impose a penalty, such penalty to be reckoned at one dollar per day, or part thereof, that elapses between the close of registration as prescribed and the filing of the petition.

12. A petition for permission to register late must be accompanied by a deposit equal to the estimated amount of the penalty. Should the Council decide that no penalty is to be imposed, the deposit will be refunded.

SECTION VI. FEES, DEPOSITS AND EXPENSES

FEES

1. A student who desires to enrol in the Faculty of Applied Science and Engineering is required to pay at least the First Term Instalment of fees on or before the opening date of the session, and before he can receive his registration card from the Secretary of the Faculty. The amount of the First Term Instalment of fees or of the Total Fee for the session may be ascertained from the schedule of fees below.

2. The Second Term Instalment of fees, if not already paid, is payable on or before January 15th. After this date an additional fee of $1.00 a month will be imposed until the whole amount is paid. All fees for the session must have been paid in full before the student can be admitted to the annual examinations.

3. In order to avoid delay in registration at the opening of the session it is recommended that at least the First Term Instalment of fees be forwarded by mail as early as possible in September, together with a form, in duplicate, to be provided by the Secretary of the Faculty and filled out by the student, giving his full name, course, year, etc.

4. University fees are payable at the Office of the Chief Accountant, Simcoe Hall, which will be open for the receipt of fees from 9 a.m. to 5 p.m. daily from September 13th to 22nd (Saturday, September 18th, 9 a.m. to 12.30 p.m.), and from 9 a.m. to 1 p.m. daily except Saturday during the remainder of the session. Cheques in payment of these fees should be made payable to the University of Toronto at par in Toronto.

5. All University Fees payable by students enrolling for courses at Ajax are payable at "The Bursar's Office, Ajax Division, University of Toronto, Ajax, Ontario". All remittances should be made at par at either Toronto or Ajax, payable to "UNIVERSITY OF TORONTO, AJAX DIVISION".

Fees forms and remittances should be mailed to the Bursar's Office, Ajax, as early as possible in order that the forms may be returned in sufficient time for registration.

Provision will be made in the Chief Accountant's Office, Simcoe Hall, Toronto, for receiving payment of fees from students registering for courses at Ajax during the registration of the first year September 16th-18th, 1948.

6. Each undergraduate enrolled in the Faculty of Applied Science and Engineering must pay annual fees to the Chief Accountant according to the schedule below; the total fee in each case is made up of the academic fee and incidental fees; all incidental fees are payable in the first term.

SCHEDULE OF FEES

Academic Year	*Academic Fee	†Incidental Fees	Total Fee (if paid in one instalment)	First Term Instalment	Second Term Instalment
Men					
First, Second, Third, Fourth (Architecture)...	$300	$41	$341	$191	$153
Fourth (final year), Fifth.....	300	51	351	201	153
Women					
First	300	27	327	177	153
Second, Third, Fourth (Architecture)...	$300	$24	$324	$174	$153
Fourth (final year), Fifth....	300	34	334	184	153

OTHER UNIVERSITY FEES

7. Each student is required to pay to the Chief Accountant at the opening of the session, or as otherwise specified, such of the following fees as may be required of him.

EQUIVALENT CERTIFICATE FEE

8. Each student who has been admitted to the First Year upon a certificate or certificates granted outside the Province of Ontario and covering all or any part of the admission requirements, must pay a fee of $5.00.

ADVANCED STANDING FEE

9. Each student who has been admitted to advanced standing from another university or college, must pay a fee of $10.00.

SUPPLEMENTAL PHYSICAL EDUCATION FEE

10. Each student who has neglected to complete satisfactorily the course in Physical Education of the First or Second Year, and who must take this work during the Second or Third Years respectively of his or her attendance, must pay a fee of $10.00.

SUPPLEMENTAL EXAMINATION FEES

11. Each candidate for a supplemental examination is required to pay a fee to the Chief Accountant not later than August 15th. The fee is $10.00 for either one or two supplemental examinations, including laboratory supplementals. For each supplemental examination in a laboratory subject requiring special supervision, there is an additional fee of $10.00. The additional laboratory supplemental fee should not be paid until the candidate is notified by the Secretary.

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*The Academic Fee includes the following fees:—
Tuition; Library, Laboratory Supply; and one Annual Examination.

†These Incidental Fees include the following fees:—
For men—Degree (for the final year only); Hart House; Students' Administrative Council; Athletic; Health Service; Physical Education; Engineering Society; Faculty Athletic Association; and Laboratory Deposit.
For women—Degree (for final year only); Students' Administrative Council; Athletic; Health Service; Physical Education (for the First Year only); Engineering Society; and Laboratory Deposit.

DEGREE FEE

12. Each candidate for the degree of Bachelor of Applied Science or Bachelor of Architecture must pay a fee of $10.00 to the Chief Accountant on or before the opening date of the session.

LABORATORY DEPOSIT

13. A laboratory breakage deposit of $10 is included in the incidental fees. This deposit, less charges for waste, neglect, and breakages will be refunded at the end of the session. Should the deposit be insufficient to meet the charges, a levy will be made to cover the deficiency.

SUMMARY OF STUDENTS' EXPENSES

14. The following approximate statement of expenses will give the student a general idea of the cost of obtaining an education in the Faculty of Applied Science and Engineering in the University of Toronto, exclusive of personal expenses:—

1. Fees, see schedule, page 31.
2. Board and Lodging, per week .... $10 up
3. Books and instruments, per year................ $50 to $60

SECTION VII. COURSES AND DEGREES

1. At the time of registration in the Faculty, the applicant is required to indicate the graduating course in which he intends to proceed to a degree. There are ten courses in Engineering, and the School of Architecture, from which the selection may be made, viz.,

Civil Engineering (Course 1),
Mining Engineering (Course 2),
Mechanical Engineering (Course 3),
Architecture (Course 4),
Engineering Physics (Course 5),
Chemical Engineering and Applied Chemistry (Course 6),
Electrical Engineering (Course 7),
Metallurgical Engineering (Course 8).
Ceramic Engineering (Course 8a).
Mining Geology (Course 9),
Aeronautical Engineering (Course 10).
Engineering and Business (Course 11).

2. The Degree of Bachelor of Applied Science will be awarded to students who complete one of the courses in Engineering, and Bachelor of Architecture to those who complete the course in Architecture.

3. The courses in Engineering extend over four academic years; the course in Architecture extends over five. A student must pass in the work of each academic year before proceeding to the work of the next. See Sec. X.

4. If, for any reason, an undergraduate wishes to change his course, he must petition the Faculty Council and obtain its approval. Such petition should be submitted by September 15.

5. Students must conform to all lecture room and laboratory regulations. Reports, briefs, theses, and drawings become the property of the Council to dispose of as it may see fit. Drawings, briefs, and field notes will not be accepted unless they have been made at the time and place provided in the time-table.

6. The curricula of the courses of instruction in Engineering and Architecture are given in Sec. IX.

7. Examinations are conducted as explained in Sec. X.

8. Students in Civil Engineering, Mining Engineering, Mechanical Engineering, Architecture, Electrical Engineering, and Mining Geology and Engineering and Business are required to have practical experience in offices, shops, or field, before their degree is granted. Students are asked to submit certificates of this experience as soon as possible after the completion of each period of work. (See Sec. IX.)

GRADUATE AND PROFESSIONAL DEGREES

1. Graduates in Engineering or Architecture may proceed to post-graduate and professional degrees. The post-graduate degrees are M. Arch., M.A.Sc., and Ph.D. The professional degrees are C.E , Chem. E., E.E., M.E. (Mechanical Engineer), M.E. (Mining Engineer), and Met. E.

2. Bursaries and scholarships for graduate students are available in limited number as shown on page 164. Many part-time demonstrator-shipsa re open which permit post-graduate work towards a degree.

3. The courses for these degrees are under the direction of the School of Graduate Studies, and candidates should send their inquiries to the Secretary of the School of Graduate Studies. Page 228 of this Calendar contains further information on graduate studies in Applied Science and Engineering.

ASSOCIATIONS OF PROFESSIONAL ENGINEERS

Graduation from the Faculty of Applied Science and Engineering leads to registration as a Professional Engineer in the various Associations of Professional Engineers throughout Canada.

SECTION VIII. SCHOOL OF ENGINEERING RESEARCH

THE SCHOOL

A School of Engineering Research, within the Faculty of Applied Science and Engineering, was established in the Spring of 1917 at the suggestion of the late Dean Ellis.

The School is under the direct supervision of a Committee of Management composed of members of the Faculty Council. To this Committee of the Council is entrusted the selection of researches to be undertaken under the auspices of the School, and the disposition of funds for conducting them.

The School was organized chiefly for the training of graduates in methods of research and for the carrying out of investigations. These latter may be problems relating to specific industries of raw materials and having a specific end in view, or general problems having to do with fundamental principles.

RESEARCH ASSISTANTS

A number of research assistants in the School of Engineering Research are appointed annually on salary in the various departments of the Faculty to carry on the work of research under direction of members of the staff. This work is accepted as partial fulfilment of the requirements for the degrees of M.A.Sc., M.Arch., and Ph.D. These research assistants are usually recent graduates, and are chosen from among those who have displayed special capacity for investigation in their undergraduate courses. Applicants should consult with members of the staff as soon as possible after the April examinations.

The facilities of the School are also open to graduates who desire to penetrate more deeply into particular phases of experimental work, or to undertake investigations either suggested by members of the staff or arising from their own work since graduation.

INQUIRIES

All communications should be sent to the Secretary of the Committee of Management, Mr. W. S. Wilson.

SECTION IX. CURRICULUM

The courses of instruction are designed to give the student a thorough grounding in the fundamentals of engineering or architecture, and, in addition, sufficient familiarity with the practical application of the principles to make him useful upon graduation. The courses are very similar in the First Year with the exception of those of Architecture, Engineering Physics, and Aeronautical Engineering. In the succeeding years specialization develops to some extent with provision in the Third and Fourth years for optional subjects in some of the graduating courses.

In the teaching of fundamentals, instruction is not confined wholly to Applied Science. As the future engineer is vitally concerned with the development of the country, it is essential that he be instructed in the rudiments of economics, administration, and business, which, with his scientific training, will enable him to increase his usefulness to the full.

Recognizing the growing emphasis of outstanding engineers and of the great professional organizations on the importance of breadth in engineering education, this Faculty liberalized its curricula in engineering and architecture, effective with the session 1944-45. The subjects that are considered to belong to the liberal stem, involving about 6 per cent of the total time of four undergraduate years, are the following: First Year English, and Engineering and Society; Second Year Economics; Third Year Modern World History, and Introduction to Political Science; Fourth Year Modern Political and Economic Trends, Philosophy of Science, and The Profession of Engineering.

Care has been taken to co-ordinate the liberal studies of the curriculum in such a manner as to form an integrated whole. Each derives support from those that have gone before and is the better understood by reason of them.

While a knowledge of these subjects does not form a part of the technical equipment of the engineer, it does add markedly to his ability to function as a broadly educated and effective citizen and thereby advances the prestige of his profession and himself in the mind of the general public.

The student who thoughtfully attends to what is offered in this so-called humanistic-social programme and follows it by self-directed reading and reflection will without question add notably to his qualifications for ultimate professional leadership. He will be the better able to discharge the double obligation laid upon him—to perform his technical duties efficiently and honourably and equally to contribute to the political, social, and cultural welfare of the community and country in which he lives.

In some graduating courses, laboratory work in the Fourth Year consists of the investigation of some specific problem. In all instances the student's knowledge of the original literature and primary sources of information is extended, and he is given a very desirable and useful training

in methods of research. In this way the undergraduate course is linked with the graduate courses (page 000), and with the work of the School of Engineering Research (page 00).

As part of the laboratory instruction, excursions to places of technical interest, both in Toronto and elsewhere, are arranged by the staff. These excursions are treated as laboratory periods with the same requirements as to attendance and reports. The total transportation costs in any one year will probably not exceed ten dollars.

On the following pages of this section, the curriculum for each course is set forth in detail. The time devoted to lectures and practical work is indicated as accurately as possible, but is subject to modification as occasion may require. The program and regulations regarding the courses of study and examination, contained in this Calendar, hold good for this academic year only, and the Faculty of Applied Science and Engineering does not bind itself to adhere for the whole period of a student's course to the conditions here laid down.

Communications relating to curricula, instruction, and examinations in the Faculty of Applied Science and Engineering should be sent to the Secretary of the Faculty.

For information regarding the courses of study leading to the post-graduate degrees, Master of Applied Science, Master of Architecture, and Doctor of Philosophy, see pages 228 and 229 of this calendar, and the calendar of the School of Graduate Studies, which gives full particulars.

CIVIL ENGINEERING

(Course 1)

The normal course in Civil Engineering has been so designed as to be broad and comprehensive, with a view to meeting not only the needs of those who have definitely decided to enter this branch of the profession, but also of those who desire a technical training of such a basic character as to enable them to enter various other fields of technical employment. Concurrent with the instruction in engineering subjects, sufficient attention is given to economic, legal, and administrative matters to make the graduate in this course fitted to enter not only upon such work as Municipal Engineering, Sanitary Engineering, Highway Engineering, Railway Engineering, Geodetic Surveying, Structural Engineering, and Hydraulic Engineering, but also upon administrative and executive work in both engineering and industrial undertakings.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Analytical Geometry, 492, page 139.

PRACTICAL EXPERIENCE

Before receiving the degree, every student in Civil Engineering is required to submit satisfactory evidence of having had at least 600 hours of practical experience. (See subject 690).

GRADUATE STUDY

Graduates of this University, or of other universities of comparable standing, who have taken the above mentioned or similar course with sufficiently high records may proceed with work leading to a graduate degree.

The time devoted to graduate study is divided between work on the subjects of mathematics, physics, fundamentals of civil engineering and related work on the approved civil engineering field of investigation chosen by the candidate.

Further information appears on page 228. The Calendar of the School of Graduate Studies should be consulted for details.

FIRST YEAR SUBJECTS COURSE 1	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry........	492 275	1	1	2	1
Calculus..................	490, 275	2	2	2	2
Chemistry.................	221, 222	2	–	2	6
Descriptive Geometry.......	270	1	–	1	–
Dynamics..................	21, 275	1	1	2	1
Electricity................	330	2	–	2	–
Engineering and Society......	322	1	–	1	–
Engineering Problems and Drawing..............	275	–	9	–	4
English...................	610	1	–	1	–
Physical Training...........	640	–	2	–	2
Practical Experience.........	690	–	–	–	–
Statics....................	20, 275	1	1	2	1
Surveying.................	710, 712	1	3	–	–

SECOND YEAR SUBJECTS COURSE 1	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Alternating Currents........	331, 350	1	–	1	3
Applied Physics.............	75, 76	1	3	1	3
Calculus..................	491	2	–	2	–
Descriptive Geometry.......	272	1	–	1	–
Dynamics..................	22	1	–	1	–
Economics.................	311	2	–	2	–
Engineering Chemistry.......	226	1	–	1	–
Engineering Problems and Drawing...............	284	–	8	–	8
Hydraulics, Elementary......	447	1	–	–	–
Least Squares..............	494	–	–	1	–
Mechanics of Materials......	23, 31	2	–	2	3
Physical Training...........	640	–	2	–	2
Practical Astronomy........	200	–	–	2	–
Practical Experience.........	690	–	–	–	–
Spherical Trigonometry......	493	1	–	–	–
Surveying.................	714, 716	1	8	1	–

THIRD YEAR SUBJECTS COURSE 1	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Applied Elasticity	33	1	–	1	–
Astronomy and Geodesy	201	–	–	2	–
Business	310	–	–	1	–
Cements and Concrete	35, 44	1	2	1	–
Construction Surveying	717	1	–	1	–
Descriptive Geometry	274	1	–	–	–
Differential Equations	507	1	1	1	1
Elementary Structural Engineering	28	2	–	2	–
Engineering Problems and Drawing	291	–	10	–	9
Engineering Geology	385, 386	1	–	2	2
Heat Engines, Theory	427, 428	1	–	1	2
Hydraulics	440, 441	2	–	2	3
Lithology	592	1	1	–	–
Machinery	463, 464	2	3	–	–
Modern World History	324	1	–	1	–
Photographic Surveying	81	1	–	–	–
Physical Metallurgy	546	–	–	1	–
Political Science	323	1	–	1	–
Practical Experience	690	–	–	–	–
Survey Camp	720	–	–	–	–

FOURTH YEAR SUBJECTS COURSE 1	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Contracts and Specifications..	315	1	–	–	–
Engineering Economics......	313	–	–	1	–
Engineering Law............	314	1	–	–	–
Foundations................	39, 299	1	–	1	–
Hydraulics.................	445, 446	2	3	2	3
Industrial Management......	318	1	–	1	–
Mechanics of Materials Lab...	38, 50	–	3	–	6
Modern Political and Economic Trends........	325	1	–	1	–
Municipal Administration....	216	–	–	1	–
Philosophy of Science........	326	1	–	½	–
Practical Experience.........	690	–	–	–	–
Profession of Engineering.....	327	–	–	½	–
Sanitary Engineering........	214, 215	1	3	1	3
Soil Mechanics..............	40	1	–	–	–
Reinforced Concrete.........	41, 299	1	6	1	6
Structural Design...........	43, 299	2		1	
Theory of Structures........	36, 299	2		2	
Thesis.....................	730	–	–	–	2
Transportation Engineering..	217	2	–	2	–

MINING ENGINEERING

(COURSE 2)

The course in Mining Engineering, which originated in 1878 as a course in Assaying and Mining Geology, is intended to serve as a preliminary training for those who expect to practise in some branch of Mining Engineering, such as exploration of mining areas and primary development; mine surveying; mining processes involving civil, mechanical and electrical work; underground operations; mining machinery and operation; milling and treatment of ores; assaying and other forms of analysis and research; and administrative work in both engineering and industrial undertakings.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Analytical Geometry, 492, page 139.

PRACTICAL EXPERIENCE

Before receiving the degree, every student in Mining Engineering is required to present satisfactory evidence of having had at least six months' practical experience. (See subject 691.)

GRADUATE STUDY

Graduates of this University, or of another university of comparable standing, who have taken the above course with a sufficiently good standing may proceed with work leading to a graduate degree.

The major portion of the student's time will be devoted to research work on some subject approved by the Department, but certain specified courses of instruction must also be taken, in which examinations are demanded.

Further information appears on page 228 of this Calendar. The Calendar of the School of Graduate Studies should be consulted for details.

FIRST YEAR SUBJECTS COURSE 2	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry	492	1	–	2	–
Calculus	490	2	–	2	–
Chemistry	221, 222	2	6	2	6
Descriptive Geometry	270	1	–	1	–
Dynamics	21	1	–	2	–
Electricity	330	2	–	2	–
Engineering and Society	322	1	–	1	–
Engineering Problems and Drawing	276	–	6	–	6
English	610	1	–	1	–
Mechanical and Thermal Measurements	448	1	–	1	–
Mineralogy, Elementary	580, 581	–	–	2	1
Mining Laboratory	165	–	2	–	–
Physical Training	640	–	2	–	2
Practical Experience	691	–	–	–	–
Statics	20	1	–	2	–
Surveying	710, 712	1	3	–	–

SECOND YEAR SUBJECTS COURSE 2	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Alternating Currents	331, 350	1	–	1	3
Analytical Chemistry Laboratory	227	–	–	–	3
Blowpipe Analysis	587	–	2	–	–
Descriptive Geometry	272	1	–	1	–
Economics	311	2	–	2	–
Engineering Problems and Drawing	285	–	8	–	8
General Geology	388, 389	2	–	1	2
Heat Engines, Elementary	420	1	–	–	–
Lithology	585	1	–	–	1
Mechanics of Materials	23, 31	2	–	2	3

SECOND YEAR SUBJECTS COURSE 2—*Continued*	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Mining	167	1	–	–	–
Optical Mineralogy, Elementary	589	–	–	1	–
Organic Chemistry	250	1	–	1	–
Physical Training	640	–	2	–	2
Practical Experience	691	–	–	–	–
Problems and Seminar	186	–	2	–	–
Surveying	715, 716	1	6	1	–
Theory of Measurements	182	1	–	–	–

THIRD YEAR SUBJECTS COURSE 2	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Chemistry	225, 237	1	4	1	3
Assaying	160, 161	1	3	1	3
Business	310	–	–	1	–
Economic Geology	399	1	–	2	–
Electrical Machinery	348	2	–	–	–
Elementary Structural Engineering	29	1	–	1	–
Engineering Problems and Drawing	292	–	3	–	–
Geological Field Work	380	–	–	–	–
Hydraulics	440, 441	2	1½	–	–
Metallurgy	530	1	–	–	–
Mining	170	1	–	1	–
Mining Laboratory	183	–	–	–	3
Modern World History	324	1	–	1	–
Ore Dressing	175, 176	–	–	2	6
Petrology Laboratory	590	–	–	–	2
Political Science	323	1	–	1	–
Practical Experience	691	–	–	–	–
Principles of Mineral Dressing	181	2	–	–	–
Problems and Seminar	186	–	2	–	–
Structural Geology	390, 391	2	3	–	3
Summer Letters	184	–	–	–	–
Survey Camp	720	–	–	–	–

FOURTH YEAR SUBJECTS COURSE 2	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Engineering Economics	313	–	–	1	–
Geology, Precambrian	392	2	–	–	–
Geology, Mining	396	–	–	2	–
Geology, Pleistocene and Physiographic	381, 382	1	1	1	–
Heat Engines, Theory	427, 428	1	1½	1	–
Hydraulics	451	–	–	1	–
Machine Design	469, 470	1	–	1	3
Metallurgy	538, 539	1	–	1	3
Mine Management	172	2	–	–	–
Mine Ventilation	173, 174	2	3	–	–
Mining	166, 171	–	–	2	6
Modern Political and Economic Trends	325	1	–	1	–
Ore Dressing	177, 178	1	6	1	–
Physical Metallurgy	546, 549	1	1	–	–
Practical Experience	691	–	–	–	–
Profession of Engineering	327	–	–	½	–
Problems and Seminar	186	–	2	–	–
Philosophy of Science	326	1	–	½	–
Summer Essays	185	–	–	2	–
Thesis	731	–	6½	–	5

MECHANICAL ENGINEERING

(COURSE 3)

The mechanical engineer is concerned with the production and the use of power; and it is part of his work to design and manufacture suitable machinery for this purpose, and to install and operate it. The internal combustion engine and the steam turbine are the products of his effort, and he applies these prime movers to automobiles, aeroplanes, locomotives, and other purposes. His work also includes the design of water turbines and their use in hydro-electric systems.

Other branches of his work are the making of designs for air compressors, machine tools, pumps, refrigerating machines and their application to storage warehouses and ice-making, heating and ventilating equipment, materials-handling and conveying plants, and generally all mechanical work. General industrial and administrative problems are considered.

The course of study has been devised to equip men for work in the general field of mechanical and industrial engineering.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Analytical Geometry, 492, page 139.

SHOP WORK

Before receiving the degree, every student in Mechanical Engineering is required to spend 1200 hours in mechanical shops, either prior to entering or during the vacations. (See subject 692.)

GRADUATE STUDY

Graduates of this University, or of another university of comparable standing, who have taken the above course, or one similar, with a sufficiently good standing may proceed with work leading to a graduate degree.

Some part of the instructional period will be devoted to advanced work in Mathematics and the Fundamentals of Engineering. The remainder of the time will be given to a study of some specific branch of Mechanical Engineering work or to some definite Mechanical problem.

Further information appears on page 228. The Calendar of the School of Graduate Studies should be consulted for details.

First Year Subjects Course 3	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry	492, 277	1	1	2	1
Calculus	490, 277	2	2	2	2
Chemistry	221, 222	2	6	2	–
Descriptive Geometry	270	1	–	1	–
Dynamics	21, 277	1	1	2	1
Electricity	330	2	–	2	–
Engineering and Society	322	1	–	1	–
Engineering Problems and Drawing	277	–	3	–	10
English	610	1	–	1	–
Mechanical and Thermal Measurements	448	1	–	1	–
Physical Training	640	–	2	–	2
Practical Experience	692	–	–	–	–
Statics	20	1	1	2	1
Surveying	710, 712	1	3	–	–

Second Year Subjects Course 3	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Calculus	491	2	–	2	–
Descriptive Geometry	272	1	–	1	–
Direct Current Machines	338	–	–	2	3
Dynamics	22	1	–	1	–
Economics	311	2	–	2	–
Electricity	332, 334	2	3	–	–
Engineering Chemistry	226	1	–	1	–
Engineering Problems and Drawing	286	–	8	–	12
Heat Engines, Elementary	420	1	–	1	–
Hydraulics, Elementary	447	1	–	–	–
Mechanical Engineering	461	2	–	–	–
Mechanics of Materials	23, 31	2	3	2	–
Physical Training	640	–	2	–	2
Practical Experience	692	–	–	–	–
Theory of Machines A	465	2	–	2	–
Treatment of Technical Data	449	–	–	2	–

THIRD YEAR SUBJECTS COURSE 3	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Alternating Current Machinery	345	–	–	2	–
Alternating Currents	340	2	–	–	–
Business	310	–	–	1	–
Electrical Laboratory	346	–	3	–	3
Elementary Structural Engineering	29, 293	1	3	1	3
Heat Engineering	422	2	–	2	–
Heat Engines, Theory	421, 423	2	3	2	3
Hydraulics	440, 441	2	–	2	3
Machine Design	467, 468	2	9	2	6
Modern World History	324	1	–	1	–
Physical Metallurgy	532	–	–	2	–
Political Science	323	1	–	1	–
Practical Experience	692	–	–	–	–
Theory of Machines B	466	2	–	–	–

FOURTH YEAR SUBJECTS COURSE 3	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Engineering Economics	313	–	–	1	–
Engineering Law	314	1	–	–	–
Heat Engine Laboratory	426	–	5	–	6
Heat Power Engineering	424	2	–	1	–
Heat Treatment of Iron and Steel	547, 548	1	–	1	$1\frac{1}{2}$
Hydraulics	442, 443, 444	2	5	3	6
Industrial Management	318	1	–	1	–
Internal Combustion and Air-Craft Engines	425	1	–	1	–
Machine Design	473, 474	2	5	2	6
Modern Political and Economic Trends	325	1	–	1	–
Philosophy of Science	326	1	–	$\frac{1}{2}$	–
Practical Experience	692	–	–	–	–
Profession of Engineering	327	–	–	$\frac{1}{2}$	–
Structural Engineering	46, 300	2	3	–	–
Thesis	732	–	1	–	1

SCHOOL OF ARCHITECTURE
(COURSE 4)

The School of Architecture is one of the oldest in the British Empire. It was established in 1890 as a Department of the School of Practical Science, later the Faculty of Applied Science and Engineering. The School is fortunate in enjoying a close connection with the Ontario Association of Architects and the Royal Architectural Institute of Canada, both of which organizations offer medals and scholarships for competition in the School.

The School is one of the architectural schools in the Empire recognized by the Royal Institute of British Architects, which admits graduates to Associate Membership on application, without examination. The Ontario Association of Architects, through its Registration Board, accepts the degree in Architecture, coupled with a two year period of office experience with an architect, as qualification to practise the profession of Architecture in the Province of Ontario.

The scope of an architect's practice in the modern world is wide and varied. He may be called upon to design buildings ranging from houses to hospitals. He may be a town planner, and an expert on dwellings for the lowest income groups. He may be an industrial designer called upon to design anything from kettles to mass produced furniture. No one can be equally skilled in all these fields, and the student is trained primarily to be an architect and a designer of buildings. With a broad training he may specialize later.

It should be clear that to enter such a course the young student should come to the School of Architecture aware of what is ahead of him as another student would to Theology or Medicine. Great architecture can be produced only by an individual in which a highly developed artistic sense and a sound mathematical sense are happily combined. The prospective student should possess the imagination and creative ability required for the work in design. He must have an orderly mind and a proficiency in mathematics for the scientific and business aspects of the profession.

The student will usually know whether his mathematics are of a sufficiently high standard to undertake the engineering and scientific courses in the School of Architecture. On the artistic side he may, in some cases, not feel so sure and would like advice. This he may obtain by writing to the School of Architecture, or, better still, by asking for an appointment with a senior member of the Staff.

PRACTICAL EXPERIENCE

Before receiving the degree, every student in the School of Architecture is required to submit satisfactory evidence of having had 12 months' (1900 hours) practical experience. (See subject 693.)

FIRST YEAR SUBJECTS COURSE 4	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Studio	Lect.	Studio
Analytical Geometry........	492	1	–	2	–
Calculus..................	490	2	–	2	–
Architectural Drawing.......	121	–	15	–	15
Building Construction.......	140	–	–	1	–
Descriptive Geometry.......	270	1	–	1	–
Elements of Arch. Form......	118	1	–	1	–
Elements of Design and Rendering..............	131	–	2	–	2
Engineering and Society......	322	1	–	1	–
Engineering Problems and Drawing................	278	–	3	–	3
History of Architecture......	110	1	–	1	–
Physical Training...........	640	–	2	–	2
Practical Experience.........	693	–	–	–	–
Statics....................	20	1	–	2	–
Surveying.................	710, 712	1	3	–	–

SECOND YEAR SUBJECTS COURSE 4	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Studio	Lect.	Studio
Architectural Design........	122	–	15	–	20
Colour....................	136	1	–	–	–
Draftsmanship and Presentation............	129	1	–	–	–
Economics.................	311	2	–	2	–
Elements of Design and Rendering..............	132	–	2	–	2
History of Architecture......	111	1	–	1	–
Materials and Methods......	126	1	–	1	–
Mechanics of Materials......	23	2	–	2	–
Model Making.............	137	–	2	–	2
Photography...............	77, 78	1	3	–	–
Physical Training...........	640	–	2	–	2
Practical Experience.........	693	–	–	–	–
Theory of Arch. Planning....	128	1	–	1	–

THIRD YEAR SUBJECTS COURSE 4	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Studio	Lect.	Studio
Architectural Design........	123	–	17	–	17
Commercial Law............	312	1	–	1	–
Elements of Design and Rendering...............	133	–	2	–	2
Functional Requirements of Buildings...............	115	1	–	1	–
Garden Design.............	116	½	–	–	–
History of Architecture A....	112	1	–	½	–
History of Architecture B....	113	2	–	1	–
Light and Acoustics.........	85, 86	1	2	1	2
Materials and Methods......	127	1	–	1	–
Measured Drawings.........	147	–	–	–	–
Modern World History.......	324	1	–	1	–
Political Science............	323	1	–	1	–
Practical Experience.........	693	–	–	–	–
Public Speaking............	320	1	–	1	–
Structural Design...........	30	2	3	2	3

FOURTH YEAR SUBJECTS COURSE 4	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Studio	Lect.	Studio
Architectural Design........	124	–	20	–	20
Building Materials					
Stone	405	1	–	–	–
Ceramic................	569	–	–	1	–
Wood..................	138	–	1	–	1
Materials and Methods...	141	–	–	1	–
Foundations................	39	1	–	1	–
Elements of Design and Rendering..............	134	–	–	–	–
History of Painting.........	119	1	–	1	–
Housing...................	130	1	–	–	–
Illumination Design.........	87, 88	1	1	1	1
Modern Political and Economic Trends........	325	1	–	1	–
Practical Experience.........	693	–	–	–	–
Sanitary Science............	142	1	–	1	–
Structural Design...........	42	1	3	1	3
Town Planning Theory......	139	1	–	–	–

FIFTH YEAR SUBJECTS COURSE 4	Subject No.	ours per week			
		First Term		Second Term	
		Lect.	Studio	Lect.	Studio
Aesthetics	148	1	–	1	–
Architectural Design	125	–	25	–	25
Architectural Economics	145	1	–	–	–
Heating and Air Conditioning	144	1	–	1	–
History of Sculpture	120	1	–	1	–
Philosophy of Science	326	1	–	½	–
Practical Experience	693	–	–	–	–
Professional Practice	143	1	–	1	–
Specifications	146	–	–	1	–
Structural Design	47	1	3	1	3
Town Planning	117	1	–	1	–

ENGINEERING PHYSICS

(COURSE 5)

Admission to and promotion in this course is granted only to students who meet the special requirements set forth on pages 26 and 158 of this Calendar.

The course is designed to afford a training in Mathematics and Physics beyond that which it is possible to give in the other undergraduate courses in engineering. It is believed that a wider and more thorough acquaintance with the basic sciences will bring to the student a readier appreciation of the nature of the technical problems with which he will later be confronted and a greater facility in the solution of them. A course of the kind offered should consequently be of particular value to those who desire to enter governmental or industrial research laboratories, or who wish to engage in any original work of investigation or development in the field of applied physics.

Throughout the four years of the course an effort is made to maintain the practical point of view in the theoretical instruction. This is effected, in part, by adopting wherever possible the engineering viewpoint in the teaching of mathematical and scientific subjects, and, in part, by the inclusion of certain basic engineering instruction.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Algebra and Calculus, 502, page 140.

FIRST YEAR SUBJECTS COURSE 5	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Algebra and Calculus	502	3½	–	3½	–
Analytical Geometry	503	1½	–	1½	–
Applied Mechanics	24	2	–	2	–
Chemistry	221, 222	2	3	2	3
Descriptive Geometry	270	1	–	1	–
Electricity	330	2	–	2	–
Engineering and Society	322	1	–	1	–
Engineering Problems and Drawing	279	–	3	–	6
English	610	1	–	1	–
Physical Training	640	–	2	–	2
Properties of Matter, Mechanics and Heat	650, 651	4	3	4	3
Surveying	710, 712	1	3	–	–

Second Year Subjects Course 5	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Acoustics	654	1	–	–	–
Analytical Geometry of Space	506	1	–	1	–
Descriptive Geometry	272	1	–	1	–
Differential Calculus	504	3	–	3	–
Dynamics	25	1	–	1	–
Economics	311	2	–	2	–
Electricity	332, 334	2	3	–	–
Elementary Light	653	1	–	1	–
Elementary Magnetism and Electricity	652	1	–	2	–
Integral Calculus and Differential Equations	505	3	–	3	–
Mathematical Problems	495	–	3	–	3
Mechanics of Materials	23, 31	2	–	2	3
Organic Chemistry	250	1	–	1	–
Physics Laboratory	655	–	3	–	6
Physical Training	640	–	2	–	2

Students in Engineering Physics are required to state at the beginning of the Third Year the options they desire to pursue in the Third and Fourth Years. Permission to enter upon an option must be sought from the Council. This may be withheld if the number of students offering, or conditions existing at the time, render it impracticable to give the work.

THIRD YEAR SUBJECTS COURSE 5	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Differential Equations	509	1	1	1	1
Direct Current Machines	339	2	–	–	–
Heat	658	1	–	1	–
Machine Design	471, 472	1	3	1	3
Mathematical Methods in Physics I	656	1	–	1	–
Modern World History	324	1	–	1	–
Physical Laboratory	659	–	3	–	3
Physical Metallurgy	532	–	–	2	–
Political Science	323	1	–	1	–
Properties of Matter	657	2	–	2	–
Theoretical Mechanics	520	1	1	1	1
Theory of Functions	508	1	1	1	1

And *one* of the following options which must be continued in the Fourth Year.

Option 5c, Electricity and Communications					
Alternating Currents	341	2	–	2	–
Electrical Design	342	2	–	–	–
Electrical Laboratory	344	–	3	–	3
Photometry	79, 80	–	–	1	3
Electronics	337	–	–	3	–
Theory of Potential	667	1	–	1	–
Option 5s, X-Rays and Spectroscopy					
Option 5i, Illumination and Acoustics					
Alternating Currents	341	2	–	2	–
Electrical Design	342	2	–	–	–
Electrical Laboratory	344	–	3	–	3
Geometrical Optics	660, 661	1	3	1	–
Photometry	79, 80	–	–	1	3
Electronics	337	–	–	3	–
Option 5g, Geophysics					
Alternating Currents	341	2	–	2	–
Electrical Laboratory	344	–	3	–	3
Engineering Geology	385, 386	1	–	2	2
Lithology	585	1	–	–	1
Mineralogy, Elementary	580, 581	2	1	–	–
Optical Mineralogy, Elementary	589	–	–	1	–

THIRD YEAR SUBJECTS COURSE 5	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Option 5r, Refrigeration					
Alternating Currents	340	2	–	–	–
Electrical Laboratory........	347	–	3	–	3
Elementary Structural Engineering.............	29, 296	1	–	1	3
Properties of Living Matter...	210	2	–	2	–
Theory of Heat Engines......	421, 423	2	3	2	3

FOURTH YEAR SUBJECTS COURSE 5	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Option 5c, Electricity and Communications					
Acoustics	97	1	–	–	–
Atomic Physics	663	2	–	2	–
Circuit Analysis	351	2	–	3	–
Communications I	360, 361	3	3	–	–
Communications II	362, 363	–	–	3	3
Differential Equations of Mathematical Physics	521	2	–	2	–
Electrical Laboratory	356	–	$4\frac{1}{2}$	–	$4\frac{1}{2}$
Transmission at Low and High Frequency	352	2	–	2	–
Electromagnetic Theory, Applied	365	2	–	2	–
Mathematical Methods in Physics II	664	2	–	–	–
Modern Political and Economic Trends	325	1	–	1	–
Operational Methods	364	2	–	2	–
Philosophy of Science	326	1	–	$\frac{1}{2}$	–
Physical Laboratory	665	–	3	–	3
Profession of Engineering	327	–	–	$\frac{1}{2}$	–
Thesis	733	–	–	–	–
Option 5s, X-Rays and Spectroscopy					
Acoustics	97	1	–	–	–
Analysis of Materials by Spectrographic and X-ray Methods	669	1	–	1	–
Atomic Physics	663	2	–	2	–
Communications I	360, 361	3	3	–	–
Differential Equations of Mathematical Physics	521	2	–	2	–
Electromagnetic Theory, Applied	365	2	–	2	–
Mathematical Methods in Physics II	664	2	–	–	–
Modern Political and Economic Trends	325	1	–	1	–
Morphological Crystallography	598	1	–	1	–

FOURTH YEAR SUBJECTS COURSE 5	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Option 5s, X-Rays and Spectroscopy (continued)					
Operational Methods	364	2	–	2	–
Optics, Advanced	666	–	–	2	–
Philosophy of Science	326	1	–	½	–
Physical Laboratory	665	–	9	–	12
Profession of Engineering	327	–	–	½	–
Thesis	733	–	–	–	–
Option 5g, Geophysics					
Atomic Physics	663	2	–	2	–
Differential Equations of Mathematical Physics	521	2	–	2	–
Economic Geology	398, 400	1	3	3	3
Electromagnetic Theory, Applied	365	2	–	2	–
Geophysics	670, 672	2	9	2	9
Location of Mineral Deposits	401	–	–	1	–
Mathematical Methods in Physics II	664	2	–	–	–
Modern Political and Economic Trends	325	1	–	1	–
Petrography	594, 595	1	2	1	2
Philosophy of Science	326	1	–	½	–
Physics of the Earth	675	2	–	2	–
Profession of Engineering	327	–	–	½	–
Structural Geology	390, 391	2	3	–	3
Thesis	733	–	–	–	–

FOURTH YEAR SUBJECTS COURSE 5	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Option 5i, Illumination and Acoustics					
Architectural Acoustics......	89,90	1	3	3	9
Atomic Physics.............	663	2	–	2	–
Communications I..........	360, 361	3	3	–	–
Differential Equations of Mathematical Physics.....	521	2	–	2	–
Mathematical Methods in Physics II...............	664	2	–	–	–
Modern Political and Economic Trends........	325	1	–	1	–
Operational Methods........	364	2	–	2	–
Philosophy of Science........	326	1	–	½	–
Photometry and Illumination Design..................	95, 96	2	6	2	6
Physical Laboratory.........	674	–	3	–	3
Profession of Engineering.....	327	–	–	½	–
Thesis.....................	733	–	–	–	–
Option 5r, Refrigeration					
Alternating Current Machinery..............	353, 367	3	3	1	–
Atomic Physics.............	663	2	–	2	–
Differential Equations of Mathematical Physics.....	521	2	–	2	–
Electronics.................	337, 368	–	–	3	3
Heat Power Engineering.....	424, 426	2	5	1	6
Heat Transfer and Refrigeration............	429	2	–	2	–
Internal Combustion Engines.	425	1	–	1	–
Low Temperature Physiology.	211, 212	1	3	1	3
Mathematical Methods in Physics II...............	664	2	–	–	–
Modern Political and Economic Trends........	325	1	–	1	–
Philosophy of Science........	326	1	–	½	–
Profession of Engineering.....	327	–	–	½	–
Thesis.....................	733	–	–	–	–
Vibration Engineering.......	99, 100	1	3	1	3

CHEMICAL ENGINEERING AND APPLIED CHEMISTRY

(COURSE 6)

The chemical engineer is concerned with the development and operation of processes by means of which matter is chemically altered to a more useful form, and in the design, construction, operation and management of plant in which to effect such changes. Apart from such obviously chemical processes as those concerned with the production of acids, alkalis, salts, petroleum, rubber products, pulp and paper, explosives, paints and varnishes, soap, plastics, etc., there are many industrial processes where chemistry plays a part, or where a knowledge of chemistry is valuable. There is thus a wide field of endeavour for the chemical engineer. In order to equip a student to enter this field, the course in chemical engineering is intended to provide the student with training in the principles of the major divisions of chemistry and chemical engineering, together with an understanding of such other engineering subjects as thermodynamics, hydraulics, electricity, mechanics of materials, and machine design.

As part of the work of the Fourth Year each student is assigned a problem involving original investigation, in order to let him apply to some extent what he has learned, and to introduce him to the chemical literature. It also serves as an introduction to research for those who are attracted to it, and who, because of their basic training are equipped to carry on research in chemistry or chemical engineering at the graduate level or in laboratories outside the university.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Analytical Geometry, 492, page 139.

GRADUATE STUDY

Graduates of this University, or of another university of comparable standing, who have taken the above course, or one similar, with a sufficiently good standing may proceed with work leading to a graduate degree.

Students wishing to pursue further studies, may proceed in the Department of Chemical Engineering to the degrees of M.A.Sc. and Ph.D.

The major portion of the student's time will be devoted to research work assigned by the Department, but certain specified courses of instruction must be taken in which examinations are demanded.

Further information appears on page 228 of this Calendar. The Calendar of the School of Graduate Studies should be consulted for details.

FIRST YEAR SUBJECTS COURSE 6	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry	492	1	–	2	–
Calculus	490	2	–	2	–
Chemistry	221, 222	2	9	2	6
Descriptive Geometry	270	1	–	1	–
Dynamics	21	1	–	2	–
Electricity	330	2	–	2	–
Engineering and Society	322	1	–	1	–
Engineering Problems and Drawing	280	–	4	–	8
English	610	1	–	1	–
Mechanical and Thermal Measurements	448	1	–	1	–
Mineralogy, Introductory	583	–	–	1	1
Physical Training	640	–	2	–	2
Statics	20	1	–	2	–
Surveying	710, 712	1	3	–	–

SECOND YEAR SUBJECTS COURSE 6	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Calculus	491	2	–	2	–
Chemical Laboratory	229	–	–	–	–
Economics	311	2	–	2	–
Electricity	332, 334	2	3	–	–
Elementary Machine Design	462	–	–	2	–
Engineering Problems and Drawing	287	–	3	–	6
German	613	1	–	1	–
Hydraulics, Elementary	447	1	–	–	–
Industrial Chemistry	230, 232	1	11	2	–

Second Year Subjects Course 6—*Continued*	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Inorganic Chemistry........	223	1	–	1	–
Mechanics of Materials......	23	2	–	2	–
Organic Chemistry..........	234, 235	2	–	2	10
Physical Chemistry.........	236	2	–	2	–
Physical Training...........	640	–	2	–	2

Third Year Subjects Course 6	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Alternating Currents........	340, 349	2	3	–	–
Business..................	310	–	–	1	–
Chemical Engineering.......	242	2	–	–	–
Chemical Theory...........	240	–	–	2	–
Electrochemistry...........	246, 247	$1\frac{1}{2}$	$1\frac{1}{2}$	–	–
German....................	614	1	–	1	–
Heat Engines, Theory.......	421, 428	2	–	2	$1\frac{1}{2}$
Hydraulics.................	440, 441	2	$1\frac{1}{2}$	2	–
Industrial Chemistry........	241, 238	1	–	1	$13\frac{1}{2}$
Metallurgy, Physical........	546	–	–	1	–
Modern World History......	324	1	–	1	–
Optics.....................	72,73	1	–	1	3
Organic Chemistry..........	244, 245	2	12	2	–
Political Science............	323	1	–	1	–

FOURTH YEAR SUBJECTS COURSE 6	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Chemical Engineering	253	1	–	1	–
Chemical Engineering Problems	252	–	–	–	2
Chemical Engineering Thermodynamics	248	1	–	1	–
Chemical Laboratory	251	–	15	–	–
Chemical Theory	259	1	–	2	–
Engineering Law	314	1	–	–	–
German	615	1	–	1	–
Graphical Methods in Chemical Engineering	254	–	1	–	1
Industrial Chemistry	258	1	–	–	–
Industrial Management	318	1	–	1	–
Machine Design	469, 470	1	–	1	3
Modern Political and Economic Trends	325	1	–	1	–
Organic Chemistry	249	1	–	1	–
Philosophy of Science	326	1	–	$\frac{1}{2}$	–
Profession of Engineering	327	–	–	$\frac{1}{2}$	–
Public Speaking	319	1	–	1	–
Thesis	734	–	5	–	16

ELECTRICAL ENGINEERING

(COURSE 7)

In following his profession, an electrical engineer will find necessary a knowledge of many fields in addition to that of applying things electrical for the benefit of humanity. For this reason the course includes not only mathematics, mechanics, physics and chemistry, but also heat engines, hydraulics, theory of mechanisms, machine design, business, economics, engineering law, and other non-electrical subjects.

In the electrical field much time is given to the calculation of circuits of electric, magnetic, and dielectric types, methods of measurement of various quantities in direct and alternating current circuits, theory of generators, motors, magnets, and other apparatus, design, electrical transmission of energy, and many related matters of interest. A great variety of problems for solution is one means of developing understanding. In the Fourth Year the proportion of time given to electrical engineering is much greater than in earlier years.

A training of this nature should, with subsequent experience, enable a student to develop into a useful and valued member of the profession, whether his natural abilities lead him into technical, commercial, or administrative responsibilities.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Analytical Geometry, 492, page 139.

PRACTICAL EXPERIENCE

Before receiving the degree, every student in Electrical Engineering is required to submit satisfactory evidence of having had 1200 hours' practical experience. (See subject 695.)

GRADUATE STUDY

Graduates of this University, or of another university of recognized standing, who have taken the above course, or one similar, and who have a satisfactory academic record may proceed with work leading to a graduate degree.

About one-half of the time will be devoted to subjects chosen from mathematics, physics, and the fundamentals of electrical engineering. The other half may be devoted to power, electronics, or communications.

Further information appears on page 228. The Calendar of the School of Graduate Studies should be consulted for details.

First Year Subjects Course 7	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry	492	1	1	2	1
Calculus	490	2	2	2	2
Chemistry	221, 222	2	–	2	6
Descriptive Geometry	270	1	–	1	–
Dynamics	21, 281	1	1	2	1
Electricity	330	2	–	2	–
Engineering and Society	322	1	–	1	–
Engineering Problems and Drawing	281	–	9	–	4
English	610	1	–	1	–
Mechanical and Thermal Measurements	448	1	–	1	–
Physical Training	640	–	2	–	2
Practical Experience	695	–	–	–	–
Statics	20, 281	1	1	2	1
Surveying	710, 712	1	3	–	–

Second Year Subjects Course 7	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Applied Physics	70,71	1	3	1	3
Calculus	491	2	3	2	3
Descriptive Geometry	272	1	–	1	–
Dynamics	22	1	–	1	–
Economics	311	2	–	2	–
Electrical Fundamentals	333	2	–	2	–
Electrical Laboratory	334	–	–	–	6
Electricity	332	–	–	2	–
Elementary Heat Engines	420	1	–	–	–
Elementary Machine Design	462	–	–	2	–
Engineering Chemistry	226	1	–	1	–
Engineering Problems and Drawing	288	–	6	–	3
Hydraulics, Elementary	447	1	–	–	–
Mechanics of Materials	23, 31	2	3	2	–
Physical Training	640	–	2	–	2
Practical Experience	695	–	–	–	–

THIRD YEAR SUBJECTS COURSE 7	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Alternating Currents	341	2	–	2	–
Business	310	–	–	1	–
Direct Current Machines	339	2	–	–	–
Electrical Design	342	2	4	–	–
Electrical Problems and Seminar	343	–	2	–	2
Electrical Laboratory	344	–	6	–	3
Electronics	337	–	–	3	–
Heat Engines, Theory	421, 423	2	3	2	–
Hydraulics	440, 441	2	–	2	3
Machine Design	475, 468	2	–	2	3
Mathematical Applications in Electrical Engineering	336	–	–	3	–
Modern World History	324	1	–	1	–
Physical Metallurgy	532	–	–	2	–
Political Science	323	1	–	1	–
Practical Experience	695	–	–	–	–

FOURTH YEAR SUBJECTS COURSE 7	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Alternating-Current Machinery I	353	3	–	1	–
Circuit Analysis	351	2	–	3	–
Communications I	360, 361	3	3	–	–
Electrical Laboratory	355	–	4½	–	1½
Electrical Problems and Seminar	371	–	2	–	2
Engineering Economics	313	–	–	1	–
Engineering Electronics	357, 358	2	1½	1	1½
Engineering Law	314	1	–	–	–
Industrial Management	318	1	–	1	–
Modern Political and Economic Trends	325	1	–	1	–
Philosophy of Science	326	1	–	½	–
Practical Experience	695	–	–	–	–
Profession of Engineering	327	–	–	½	–
Thesis	735	–	–	–	–
Transmission at Low and High Frequencies	352	2	–	2	–
*And at least three of the following subjects, one of which must be either Communications II or Alternating Current Machinery II:**					
Acoustics	82, 83	–	–	2	1½
Alternating-Current Machinery II	369, 370	–	–	2	1½
Communications II	362, 363	–	–	3	3
Electrical Design	359	–	–	2	2
Illumination	93, 94	–	–	2	3
Ultra-High Frequency Communications	371, 372	–	–	2	1½

*Due to overcrowded facilities, it may be necessary, during the session 1948-49, to restrict the choice of elective subjects to certain groupings.

METALLURGICAL ENGINEERING

(COURSE 8)

The metallurgical engineer is concerned with the winning of metals from ores. Since virgin metals rarely possess useful physical properties, the second task of the metallurgist is to produce alloys, such as steel, which have suitable physical properties.

No other materials approach the metals in strength, and the whole fabric of modern civilization is dependent on their properties. The fields of employment for graduates lie in production metallurgical industries, the industries which fabricate metals, and in sales and research. Metallurgical research facilities have notably been increased in recent years in Canada.

The course is designed to give the student a firm grasp of the chemical fundamentals upon which metallurgical reactions are based. Engineering courses are provided to give a general knowledge of hydraulics, mechanics of materials, etc.

Courses in production metallurgy cover the theory and practice of winning aluminium, copper, iron, lead, magnesium, nickel, zinc, etc., from their ores. Physical metallurgy courses cover the production, heat treatment, microscopic and physical examination of alloys.

The subjects of instruction are shown in the following pages. In these tables, reference numbers have been assigned to the subjects referring to a more detailed description of each, e.g., Analytical Geometry 492, page 139.

GRADUATE STUDY

Graduates of this University, or of another university of comparable standing, who have taken the above course, or one similar, with a sufficiently good standing, may proceed with work leading to a graduate degree.

Students wishing to pursue further studies, whether in extractive metallurgy or physical metallurgy, may proceed in the Department of Metallurgical Engineering to the degrees M.A.Sc. and Ph.D.

A major part of the time will be spent on research work, while the remainder will be devoted to subjects chosen from Physics, Chemistry, Mining, Mineralogy and Metallurgy.

Further information appears on page 228 and in the Calendar of the School of Graduate Studies.

FIRST YEAR SUBJECTS COURSE 8	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry	492	1	–	2	–
Calculus	490	2	–	2	–
Chemistry	221, 222	2	6	2	6
Descriptive Geometry	270	1	–	1	–
Dynamics	21	1	–	2	–
Electricity	330	2	–	2	–
Engineering and Society	322	1	–	1	–
Engineering Problems and Drawing	282	–	8	–	7
English	610	1	–	1	–
Mechanical and Thermal Measurements	448	1	–	1	–
Mineralogy, Introductory	583	–	–	1	1
Physical Training	640	–	2	–	2
Statics	20	1	–	2	–
Surveying	710, 712	1	3	–	–

SECOND YEAR SUBJECTS COURSE 8	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Alternating Currents	331,350	1	–	1	3
Analytical Chemistry Laboratory	228	–	9	–	9
Calculus	491	2	–	2	–
Economics	311	2	–	2	–
Electricity	332, 334	2	3	–	–
Elementary Machine Design	462	–	–	2	–
Engineering Problems and Drawing	289	–	3	–	3
Fuels and Combustion	531	1	–	1	–
Hydraulics, Elementary	447	1	–	–	–
Inorganic Chemistry	223	1	–	1	–
Mechanics of Materials	23	2	–	2	–
Metallurgy	530	1	–	–	–
Mining	168	1	–	1	–
Optics	74	1	–	1	–
Physical Chemistry	236	2	–	2	–
Physical Training	640	–	2	–	2

THIRD YEAR SUBJECTS COURSE 8	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Chemistry	225	1	–	1	–
Assaying	160, 161	1	3	1	3
Business	310	–	–	1	–
Electrical Machinery	348	2	–	–	–
Electrochemistry	246, 247	$1\frac{1}{2}$	3	–	–
Heat Engines, Theory	427, 428	1	–	1	$1\frac{1}{2}$
Metallography Laboratory	537	–	3	–	3
Metallurgical Theory	239	2	–	2	–
Modern World History	324	1	–	1	–
Ore Dressing	175, 176	–	–	2	6
Political Science	323	1	–	1	–
Principles of Metallurgical Engineering	534, 535	2	6	1	6
Principles of Physical Metallurgy	536	2	–	2	–
Principles of Mineral Dressing	181	2	–	–	–
Refractories and Metallurgy	573	1	–	1	–

FOURTH YEAR SUBJECTS COURSE 8	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Engineering Economics	313	–	–	1	–
Ferrous Production Metallurgy	552	1	–	1	–
Machine Design	469, 470	1	–	1	3
Metallography Laboratory	544	–	3	–	3
Metallurgical Theory	550	1	–	1	–
Metallurgy Problems	540	2	–	2	–
Modern Political and Economic Trends	325	1	–	1	–
Non-Ferrous Metallurgy	541, 542	1	6	1	3
Ore Dressing	177, 178	1	6	1	–
Philosophy of Science	326	1	–	$\frac{1}{2}$	–
Physical Metallurgy	543, 545	2	3	2	–
Plant Management	317	–	–	1	–
Profession of Engineering	327	–	–	$\frac{1}{2}$	–
Thesis	736	–	4	–	11

CERAMIC ENGINEERING

(COURSE 8a)

The course in Ceramics offers a training for those who intend to work as engineers in the ceramic and industrial mineral industries. Ceramics deals with the preparation of raw materials for, and the manufacture and use of, such products as refractories, cement, heavy clay products, porcelain, pottery, glass and enamelled iron. Industrial mineral engineering includes the beneficiation and commercial utilization of minerals, not primarily used for the production of metals. Such minerals include asbestos, clay, diatomite, feldspar, gypsum, limestone, mica, quartz, talc, etc.

In the manufacture of fused silicates, such as glasses, glazes and enamels, both clear and coloured and in the manufacture of special bodies such as those used for thermal and electrical insulation, practically every chemical element obtainable on a commercial basis may be used. The subject matter is essentially inorganic chemical engineering with an emphasis upon high temperature chemistry. The natural field of employment for graduates would be for the technical, production and sales divisions of the industry.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, e.g., Analytical Geometry 492, page 139.

GRADUATE STUDY

Graduates of this University, or of another university of comparable standing, who have taken the above course, or one similar, with a sufficiently good standing, may proceed with work leading to a graduate degree. A part of the time will be devoted to subjects chosen from physics, chemistry and others approved by the School of Graduate Studies, while the remainder will be devoted to research in the same phase of the ceramic field.

Further information appears on page 228. The Calendar of the School of Graduate Studies should be consulted for further details.

First Year Subjects Course 8a	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry	492	1	–	2	–
Calculus	490	2	–	2	–
Chemistry	221, 222	2	9	2	6
Descriptive Geometry	270	1	–	1	–
Dynamics	21	1	–	2	–
Electricity	330	2	–	2	–
Engineering and Society	322	1	–	1	–
Engineering Problems and Drawing	283	–	5	–	7
English	610	1	–	1	–
Mechanical and Termal Measurements	448	1	–	1	–
Mineralogy, Introductory	583	–	–	1	1
Physical Training	640	–	2	–	2
Statics	20	1	–	2	–
Surveying	710, 712	1	3	–	–

Second Year Subjects Course 8a	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Chemical Laboratory	228	–	9	–	9
Ceramics, Introductory	572	2	–	–	–
Economics	311	2	–	2	–
Elementary Machine Design	462	–	–	2	–
Electricity	332, 334	2	3	–	–
Engineering Problems and Drawing	290	–	3	–	6
Fuels and Combustion	531	1	–	1	–
Hydraulics, Elementary	447	1	–	–	–
Industrial Chemistry	230	1	–	2	–
Inorganic Chemistry	223	1	–	1	–
Mechanics of Materials	23	2	–	2	–
Optics	74	1	–	1	–
Organic Chemistry	250	1	–	1	–
Physical Chemistry	236	2	–	2	–
Physical Training	640	–	2	–	2

THIRD YEAR SUBJECTS COURSE 8a	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Alternating Currents	340, 349	2	3	–	–
Assaying Laboratory	164	–	1½	–	–
Business	310	–	–	1	–
Ceramic Calculations	563	1	–	–	–
Ceramic Minerals	560	3	–	2	–
Ceramics	562	–	–	2	–
Ceramics Laboratory	564	–	6½	–	7
Chemical Engineering	242	2	–	–	–
Chemical Theory	240	–	–	2	–
Elementary Structural Engineering	29	1	–	1	–
Engineering Problems and Drawing	297	–	3	–	3
Heat Engines, Theory	421, 428	2	–	2	1½
Heavy Clay Products Laboratory	561	–	6	–	6
Modern World History	324	1	–	1	–
Optical Mineralogy, Elementary	589	–	–	1	–
Physical Metallurgy	532	–	–	2	–
Political Science	323	1	–	1	–

FOURTH YEAR SUBJECTS COURSE 8a	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Ceramic Calculations (1948-49 only)	563	1	–	–	–
Economic Geology	402	–	–	2	–
Glass and Enamels	566	1	–	1	–
Hydraulics	440, 441	2	3	–	–
Industrial Management	318	1	–	1	–
Machine Design	469, 470	1	–	1	3
Modern Political and Economic Trends	325	1	–	1	–
Optical Mineralogy Laboratory	596	–	2	–	2
Ore Dressing Laboratory	180	–	3	–	3
Philosophy of Science	326	1	–	½	–
Principles of Mineral Dressing	181	2	–	–	–
Profession of Engineering	327	–	–	½	–
Refractories and Ceramic Bodies	565	2	–	1	–
Thesis	737	–	6	–	9
Whitewares and Enamels Laboratory	568	–	6	–	6

MINING GEOLOGY

(COURSE 9)

The course in Mining Geology is designed to train more particularly those who wish to enter the field of applied geology, but it is sufficiently broad to provide training for work in any branch of geology, unless it be that in which an extensive knowledge of palaeontology is necessary.

The economic geologist is frequently brought into contact with engineering problems and it is essential that he receive a good grounding in those subjects, such as mathematics, mechanics, chemistry, physical sciences, surveying, and engineering drawing, that constitute the preliminary work in engineering courses. It is necessary that he understand something of the language and methods of the mining, metallurgical, and construction engineer with whom he must co-operate in his work around mines, dams, and other engineering works. The first two years of this course are the same as those in Mining Engineering, since that course provides the essential preliminary work, and some mining and metallurgy are taken in the other years to broaden the knowledge of the geologist in the work of those with whom he must co-operate.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Analytical Geometry, 492, page 139.

PRACTICAL EXPERIENCE

Before receiving the degree every student in Mining Geology, is required to submit satisfactory evidence of having had six months' practical experience. (See subject 696.)

GRADUATE STUDY

Graduates in the above course, or in a similar one in any university with standards comparable to this University, with a sufficiently good standing, may proceed with work leading to a higher degree.

Work for such degree will include the preparation of a thesis on an approved subject, together with the study of such subjects as advanced structural geology, economic geology, mining, metamorphism, and geophysics.

Further information appears on page 228. The Calendar of the School of Graduate Studies should be consulted for details.

FIRST YEAR SUBJECTS COURSE 9	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry........	492	1	–	2	–
Calculus..................	490	2	–	2	–
Chemistry.................	221, 222	2	6	2	6
Descriptive Geometry.......	270	1	–	1	–
Dynamics..................	21	1	–	2	–
Electricity................	330	2	–	2	–
Engineering and Society......	322	1	–	1	–
Engineering Problems and Drawing................	276	–	6	–	6
English...................	610	1	–	1	–
Mechanical and Thermal Measurements...........	448	1	–	1	–
Mineralogy, Elementary......	580, 581	–	–	2	1
Mining Laboratory..........	165	–	2	–	–
Physical Training...........	640	–	2	–	2
Practical Experience.........	696	–	–	–	–
Statics....................	20	1	–	2	–
Surveying..................	710, 712	1	3	–	–

SECOND YEAR SUBJECTS COURSE 9	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Alternating Currents........	331, 350	1	–	1	3
Analytical Chemistry Laboratory..............	227	–	–	–	3
Blowpipe Analysis...........	587	–	2	–	–
Descriptive Geometry.......	272	1	–	1	–
Economics.................	311	2	–	2	–
Engineering Problems and Drawing................	285	–	8	–	8
General Geology............	388, 389	2	–	1	2
Heat Engines, Elementary....	420	1	–	–	–
Lithology..................	585	1	–	–	1
Mechanics of Materials......	23,31	2	–	2	3

SECOND YEAR SUBJECTS COURSE 9—*Continued*	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Mining	167	1	–	–	–
Optical Mineralogy, Elementary	589	–	–	1	–
Organic Chemistry	250	1	–	1	–
Physical Training	640	–	2	–	2
Practical Experience	696	–	–	–	–
Problems and Seminar	186	–	2	–	–
Surveying	715, 716	1	6	1	–
Theory of Measurements	182	1	–	–	–

THIRD YEAR SUBJECTS COURSE 9	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Chemistry	225, 237	1	4	1	3
Assaying	160, 161	1	3	1	3
Business	310	–	–	1	–
Economic Geology	398, 400	1	3	3	3
Geological Field Work	380	–	–	–	–
Historical Geology	383, 384	2	2	2	2
Metallurgy	530	1	–	–	–
Mining	170	1	–	1	–
Modern World History	324	1	–	1	–
Petrography	594, 595	1	2	1	2
Physical Chemistry	236	2	–	2	–
Political Science	323	1	–	1	–
Practical Experience	696	–	–	–	–
Precambrian and Economic Geology Laboratory	397	–	–	–	2
Principles of Mineral Dressing	181	2	–	–	–
Structural Geology	390, 391	2	3	–	3
Survey Camp	720	–	–	–	–

FOURTH YEAR SUBJECTS COURSE 9	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Engineering Economics......	313	–	–	1	–
Geology of Canada...........	403, 404	2	–	1	2
Geology, Mining.............	393, 394	2	3	1	3
Geology, Pleistocene and Physiographic...........	381, 382	1	1	1	–
Geology, Precambrian.......	392	2	–	–	–
Geophysics.................	671, 673	2	6	2	6
Mine Management..........	172	2	–	–	–
Mineralography Laboratory..	597	–	2	–	2
Mining....................	166, 171	–	–	2	3
Modern Political and Economic Trends........	325	1	–	1	–
Optical Mineralogy Laboratory..............	596	–	2	–	2
Practical Experience.........	696	–	–	–	–
Profession of Engineering.....	327	–	–	$\frac{1}{2}$	–
Philosophy of Science........	326	1	–	$\frac{1}{2}$	–
Physical Metallurgy.........	546, 549	1	1	–	–
Thesis.....................	738	–	4	–	6

AERONAUTICAL ENGINEERING

(COURSE 10)

Admission to and promotion in this course is granted only to students who meet the special requirements set forth on pages 26 and 158 of this Calendar.

The course is designed to provide a sound training in mathematics and science in the First and Second Years, together with certain fundamental subjects pertaining to the practice of aeronautical engineering. In the Third and Fourth Years, training is provided in those subjects now generally recognized as belonging strictly to the design, construction, and operation of aircraft.

The training in this course is planned to fit graduates to enter the technical design staffs of aircraft manufacturing companies. In Canada, Great Britain and the United States, due to the necessary emphasis on mass production for war purposes, there is a shortage of personnel training to enter design staffs. In these countries there will be opportunities for graduates in Aeronautical Engineering.

Students desiring to enter the Third Year of this course must have had at least two hours of instructional flying.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Algebra and Calculus, 502, page 140.

GRADUATE STUDY

Graduates of this University, or of other Universities of comparable standing, who have taken the above mentioned or similar course with sufficiently high records may proceed with work leading to a graduate degree.

The time devoted to graduate study is divided between work on the subjects of mathematics, aerodynamics, and related subjects to the approved field of investigation chosen by the candidate.

Further information appears on page 228. The Calendar of the School of Graduate Studies should be consulted for details.

FIRST YEAR SUBJECTS COURSE 10	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Algebra and Calculus	502	3½	–	3½	–
Analytical Geometry	503	1½	–	1½	–
Applied Mechanics	24	2	–	2	–
Chemistry	221, 222	2	3	2	3
Descriptive Geometry	270	1	–	1	–
Electricity	330	2	–	2	–
Engineering and Society	322	1	–	1	–
Engineering Problems and Drawing	279	–	3	–	6
English	610	1	–	1	–
Physical Training	640	–	2	–	2
Properties of Matter; Mechanics and Heat	650, 651	4	3	4	3
Surveying	710, 712	1	3	–	–

SECOND YEAR SUBJECTS COURSE 10	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Acoustics	654	1	–	–	–
Aeronautics	11	1	–	1	–
Analytical Geometry of Space	506	1	–	1	–
Descriptive Geometry	272	1	–	1	–
Differential Calculus	504	3	–	3	–
Dynamics	25	1	–	1	–
Economics	311	2	–	2	–
Elementary Light	653	1	–	1	–
Elementary Magnetism and Electricity	652	1	–	2	–
Engineering Problems and Drawing	286	–	6	–	6
Heat Engines, Elementary	420	1	–	–	–
Integral Calculus and Differential Equations	505	3	–	3	–
Mechanics of Materials	23, 31	2	–	2	3
Physical Training	640	–	2	–	2
Physics Laboratory	655	–	3	–	6
Theory of Machines A	465	2	–	2	–

THIRD YEAR SUBJECTS COURSE 10	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Advanced Engineering Mechanics	27	1	–	1	–
Aeronautics	1	1	–	1	–
Aircraft Layout	12	–	–	–	3
Airplane Stress Analysis	9, 10	1	3	1	3
Alternating Currents	340	2	–	–	–
Applied Elasticity	33	1	–	1	–
Differential Equations	509	1	1	1	1
Direct Current Machines	338	–	–	2	–
Elementary Structural Engineering	29	1	–	1	–
Heat Engines, Theory	421, 423	2	3	2	3
Fluid Mechanics	34	1	–	1	–
Machine Design	467, 468	2	6	2	6
Modern World History	324	1	–	1	–
Political Science	323	1	–	1	–
Theory of Functions	508	1	1	1	1

FOURTH YEAR SUBJECTS COURSE 10	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Aircraft Electricity	366	–	–	1	–
Aircraft Hydraulics	452	1	–	–	–
Aircraft Materials	551	1	–	1	–
Airplane Design and Layout	5, 6	2	9	2	9
Airplane Stress Analysis	7, 8	2	3	2	3
Applied Aerodynamics	3, 4	2	6	2	6
Differential Equations of Mathematical Physics	521	2	–	2	–
Elastic Analysis	32	1	–	1	–
Gas Dynamics	26	2	–	2	–
Internal Combustion and Aircraft Engines	425	1	–	1	–
Modern Political and Economic Trends	325	1	–	1	–
Philosophy of Science	326	1	–	$\frac{1}{2}$	–
Profession of Engineering	327	–	–	$\frac{1}{2}$	–
Thesis	739	–	–	–	–

ENGINEERING AND BUSINESS

(COURSE 11)

A substantial proportion of those who are admitted to the Faculty of Applied Science and Engineering have no particular interest in any one branch of technology, but desire a broad general training, preponderately engineering in character, that will fit them rather for executive or administrative positions, than for those of a purely technical or design nature. Many engineers nowadays occupy positions of responsibility in sales, production, purchasing, and other similar branches of industry, and for those who wish to enter such fields, the training offered should contain a greater proportion of economic, business, and management instruction than is possible in the distinctively technical courses.

The course in Engineering and Business is designed to cover that field and to be suitable for those who require such training. It is not expected that graduates from this course will immediately enter upon executive work; indeed, their early work may be almost entirely of a technical character, but it is anticipated that their ultimate tendency will be toward positions in the field of management or business. Their progress in that direction will depend largely on their own industry and abilities. Moreover, all engineers, whatever their duties may be, must be able to handle men as well as machines and their duties tend to become more and more administrative in character as they assume positions of increasing responsibility.

The subjects of instruction are shown in the following tables. In these tables, reference numbers have been assigned to the subjects referring to a more detailed description of each, e.g., Calculus 491, page 139.

Before receiving the degree, every student in Engineering and Business is required to submit satisfactory evidence that he has had practical experience satisfactory to the Committee administering the course.

FIRST YEAR SUBJECTS COURSE 11	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry	492,277	1	1	2	1
Calculus	490,277	2	2	2	2
Chemistry	221,222	2	6	2	–
Descriptive Geometry	270	1	–	1	–
Dynamics	21,277	1	1	2	1
Electricity	330	2	–	2	–
Engineering and Society	322	1	–	1	–
Engineering Problems and Drawing	277	–	3	–	10
English	610	1	–	1	–
Mechanical and Thermal Measurements	448	–	–	2	–
Physical Training	640	–	2	–	2
Practical Experience	698	–	–	–	–
Statics	20	1	1	2	1
Surveying	710,712	1	3	–	–

SECOND YEAR SUBJECTS COURSE 11	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Applied Physics	70, 71	1	3	1	3
Calculus	491	2	–	2	–
Descriptive Geometry	272	1	–	1	–
Direct Current Machines	338	–	–	2	3
Dynamics	22	1	–	1	–
Economics	311	2	–	2	–
Electricity	332, 334	2	3	–	–
Engineering Chemistry	226	1	–	1	–
Engineering Problems and Drawing	286	–	6	–	8
Heat Engines, Elementary	420	1	–	1	–
Hydraulics, Elementary	447	1	–	–	–
Industrial Chemistry	230	1	–	1	–
Mechanics of Materials	23, 31	2	3	2	–
Physical Metallurgy	532	–	–	2	–
Physical Training	640	–	2	–	2
Practical Experience	698	–	–	–	–
Public Speaking	320	–	–	–	1

THIRD YEAR SUBJECTS COURSE 11	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Accounting	306	2	1	2	1
Alternating Currents	340, 346	2	3	–	–
Applied Economics	308	2	–	2	2
Elementary Structural Engineering	29	1	–	1	–
Engineering Problems and Drawing	298	–	6	–	3
Heat Engines, Theory	421, 423	2	–	2	3
Hydraulics	440, 441	2	–	2	3
Industrial Management A	321	1	2	2	1
Machine Design	467, 468	2	3	2	3
Modern World History	324	1	–	1	–
Political Science	323	1	–	1	–
Practical Experience	698	–	–	–	–
Statistics	307	2	–	2	–

FOURTH YEAR SUBJECTS COURSE 11	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Alternating Current Machinery	345, 346	–	–	2	3
Business Policy	309	3	2	3	2
Engineering Economics	313	–	–	1	–
Engineering Law	314	1	–	–	–
Heat Treatment of Iron and Steel	547, 548	1	–	1	1½
Industrial Management B	328	2	3	2	3
Industrial Psychology	329	2	–	2	–
Light and Acoustics	91, 92	1	1½	1	1½
Manufacturing Processes	476, 477	2	3	2	3
Modern Political and Economic Trends	325	1	–	1	–
Philosophy of Science	326	1	–	½	–
Practical Experience	698	–	–	–	–
Profession of Engineering	327	–	–	½	–
Structural Engineering	46, 300	2	3	–	–
Thesis	740	–	1	–	1

OUTLINE OF LECTURE AND LABORATORY SUBJECTS

On the pages that follow a brief description is given of the lectures and laboratory subjects prescribed in the preceding tables of curriculum. The numbers before the subjects are the reference numbers assigned in the tables. For example, 20. Statics, means the course of lectures indicated by this number in the table of curriculum for the First Year on page 39.

AERONAUTICAL ENGINEERING

1. Aeronautics. T. R. Loudon.

Course 10, III Year; 1 hr. lecture per week, both terms.

An introductory course on the basic principles of aerodynamics and theory of flight. The elements of stability and control are discussed and the fundamental theory of performance estimation is outlined in these lectures.

Text books: Technical Aerodynamics—K. D. Wood. Aerodynamics of the Airplane—Millikan. Theory of Flight—Von Mises.

3. Applied Aerodynamics. B. Etkin.

Course 10, IV Year; 2 hrs. lectures per week, both terms.

An advanced course in aerodynamic theory, in which the following topics are discussed: performance estimation and calculation, airfoil theory, propellors, wind tunnel corrections, drag, stability and control, spinning, rotary wing aircraft, compressibility effects.

Text books: Applied Aerodynamics—Bairstow. Airfoil and Airscrew Theory—Glauert. Aerodynamics of the Airplane—Millikan. Aerodynamics Theory—Durand.

4. Applied Aerodynamics Laboratory. B. Etkin.

Course 10, IV Year; 6 hrs. laboratory per week, both terms.

This subject is intended to amplify the lecture course on hydrodynamics and aerodynamics. The calibration and practical use of wind tunnel instruments are explained, and experiments are carried out to illustrate the points discussed in the lectures.

5. Airplane Design and Layout. T. R. Loudon, B. S. Shenstone, J. W. Jakimiuk, W. H. Jackson, W. Czerwinski.

Course 10, IV Year; 2 hrs. lectures per week, both terms.

Methods of application of aerodynamic theory and stress analysis to the design of airplanes are discussed. Problems are set for the laboratory periods in which actual airplane layouts are made and stressed for the required conditions in practice.

Text books: Air Ministry Publications 970 and 1208. C.A.M.-04. C.A.M.-05.

6. Airplane Design and Layout Laboratory. T. R. Loudon, B. S. Shenstone, W. J. Jakimiuk, W. H. Jackson, W. Czerwinski.

Course 10, IV Year; 9 hrs. laboratory per week, both terms.

In this subject, the principles from the various lecture subjects on aerodynamics, stress analysis and layout are applied to the design of an aeroplane as a whole, and to its component parts. The British Air Ministry and U.S.A. specifications used in Canada are applied to these design problems.

7. Airplane Stress Analysis. T. R. Loudon.

Course 10, IV Year; 2 hrs. lectures per week, both terms.

An advanced course continuing the work of the Third Year on aircraft framed structures and stringer skin combinations. Shear flow in open and closed sections is discussed. Strain energy, the elastic centre and moment distribution methods are outlined. Simple and continuous beam columns are analyzed and various other structural problems encountered in aircraft design are taken up and problems worked out.

Text books: Airplane Structures—Niles and Newell. Airplane Structural Analysis and Design—Sechler and Dunn. Analysis and Design of Airplane Structures—Bruhn.

8. Airplane Stress Analysis. T. R- Loudon.

Course 10, IV Year; 3 hrs. laboratory work per week, both terms.

Problems are worked out using the theory explained in the lectures of subject 7. These problems all relate to aircraft.

9. Airplane Stress Analysis. T. R. Loudon.

Course 10, III Year; 1 hr. lecture per week, both terms.

Elementary principles of advanced structural analysis used in aircraft design. Problems are set to be worked out in the laboratory.

Text books: Airplane Structures—Niles and Newell. Airplane Structural Analysis and Design—Sechler and Dunn. Analysis and Design of Airplane Structures—Bruhn.

10. Airplane Stress Analysis Laboratory. T. R. Loudon.

Course 10, III Year; 3 hrs. laboratory per week, both terms.

Problems based upon the lectures in subject 9 are worked out during these periods.

11. Aeronautics. T. R. Loudon.

Course 10, II Year: 1 hr. lecture per week, both terms.

An introductory course to the work of III Year Aeronautics (1).

12. Aircraft Layout. W. J. Jakimiuk, W. Jackson.

Course 10, III Year; 3 hrs. laboratory per week, second term.

Methods of layout and detailing peculiar to the aircraft industry.

APPLIED MECHANICS AND DESIGN OF STRUCTURES

20. Statics. T. R. Loudon.

Courses 1, 2, 3, 4, 6, 7, 8, 8a, 9, and 11, I Year; 1 hr. lecture per week, first term; 2 hrs. lectures per week, second term.

Fundamental principles of the laws of equilibrium of forces are discussed. These principles are applied to the determination of stresses in simple structures. Toward the end of the subject an introduction to Mechanics of Materials is given.

Text book: Engineering Mechanics-Statics—Timoshenko and Young.

21. Dynamics. M. W. Huggins, B. Etkin.

Courses 1, 2, 3, 6, 7, 8, 8a, 9, and 11, I Year; 1 hr. lecture per week, first term; 2 hrs. lectures per week, second term.

A subject designed to extend the elementary principles of preparatory school mechanics to a more general viewpoint. Under the heading of kinematics, the general equations of motion, both linear and angular, are developed.

Centres of mass and moments of inertia are calculated.

The principles of linear and angular momentum are dealt with and a fairly comprehensive course on effective and inertia forces as applied to engineering problems is given. The discussion of energy, work, and power is extended as far as possible to practical problems.

Simple harmonic motion is also discussed.

Text book: Principles of Physics, Mechanics—Sears.

22. Dynamics. I. W. Smith.

Courses 1, 3, 7 and 11, II Year; 1 hr. lecture per week, both terms.

Motion of a point is reviewed and extended to include Coriolis' acceleration, with applications. Equations for motion of mass in translation, rotation, and plane motion are developed, including centre of percussion. Moment of inertia of mass is studied by double integration and by the lamina method. The derivation and application of gyroscopic action is thoroughly discussed, and an introduction to static and dynamic balancing is given.

Text book: Analytical Mechanics for Engineers—Seeley and Ensign.

23. Mechanics of Materials. T. R. Loudon, M. W. Huggins.

All courses, II Year; 2 hrs. lectures per week, both terms.

In this subject, the fundamental theories of stress and strain are discussed and applied in the design of tension members, riveted joints, pipes and tanks, beams, columns, shafts, etc. A number of problems are worked out both in the lecture course and in the drafting room.

Text books: Resistance of Materials—Seely.

24. Applied Mechanics. B. Etkin.

Courses 5 and 10, I Year; 2 hrs. lectures per week, both terms.

This subject is divided into two parts: one dealing with the application of the principles of statics to elementary framed structures and simple beams, and the other dealing with the fundamental principles of dynamics of a particle extended eventually to consideration of rigid bodies.

Text books: Engineering Mechanics (Vol. 1)—Timoshenko and Young. Principles of Physics, Mechanics—Sears.

25. Dynamics. B. Etkin.

Courses 5 and 10, II Year; 1 hr. lecture per week, both terms.

Introduction to vectors; general plane motion of particles systems of particles, and rigid bodies; compound pendulum, centre of percussion, gyroscopes.

Text books: Engineering Mechanics (vol. 2)—Timoshenko and Young. Principles of Mechanics—Synge and Griffiths.

26. Gas Dynamics. G. N. Patterson.

Course 10, IV Year; 2 hrs. lectures per week, both terms.

An advanced course in the aerodynamic theory of compressible fluids. The main topics are: one dimensional gas dynamics, shock waves, method of small perturbations, characteristics, hodograph method, application to subsonic and supersonic aerofoils, transonic problems, experimental methods.

27. Advanced Engineering Mechanics. B. Etkin.

Course 10, III Year; 1 hr. lecture per week, both terms.

Introduction to the operators curl, div. and grad. Plane and Space dynamics using the vector rotation. Euler's equation for a rigid body. Lagranges equations. Vibrations. Dimensional analysis and model testing.

Text books: Principles of Mechanics—Synge and Griffiths. Engineering Mechanics (vol. 2)—Timoshenko and Young.

28. Elementary Structural Engineering. C. F. Morrison.

Course 1, III Year; 2 hrs. lectures per week, both terms.

An elementary study of the stress analysis and design of structures, structural members, and their details. Problems in analysis and design are worked out in the lectures and in the drafting room.

The work in the first term includes a discussion of tension members, steel and timber columns, simple and continuous beams, box girders, and plate girders. Welding as a method of connecting structural steel members is studied.

The second term is given chiefly to moving loads, the design of a riveted truss highway span, and the theory of railway truss spans.

Text books: Theory of Simple Structures—Shedd and Vawter. Structural Problems—Young. Steel Construction Handbook—A.I.S.C.

29. Elementary Structural Engineering. M. W. Huggins,

Courses 2, 3, 5r, 8a, 10, and 11, III Year; 1 hr. lecture per week, both terms.

Practically the same work as that for subject 28 in the first term.

30. Structural Design, C. F. Morrison.

Course 4, III Year; 2 hrs. lectures and 3 hrs. problems per week, both terms.

The stress analysis and design of elementary structures and structural members of timber, steel and reinforced concrete are studied in this subject. Practical problems on the design of beams, columns, piers, footings, and roof trusses are worked out in the drafting room. Some time is spent testing and determining the physical properties of structural materials.

Reference books: Architectural Construction—Gay and Parker. Design of Steel Buildings—Hauf. Elementary Structural Engineering—Urquhart and O'Rourke.

31. Mechanics of Materials: General. T. R. Loudon, W. L. Sagar, C. E. Helwig.

Courses 1, 2, 5, 9 and 10, II Year; 3 hrs. laboratory per week, second term.

Courses 3, 7, and 11, II Year; 3 hrs. laboratory per week, first term.

An introduction to the experimental study of the strength and elasticity of engineering materials. In it he should acquire a first hand knowledge of the properties of certain common materials of construction, and some familiarity with the manner in which they might be expected to behave when subjected to loads.

Reference book: Junior Laboratory Course in Mechanics of Materials, Department of Civil Engineering; Municipal and Structural.

32. Elastic Analysis. A. Grzedzielski.

Course 10, IV Year; 1 hr. lecture per week, both terms.

The general analysis of stress and strain is discussed and applied to aircraft problems.

33. Applied Elasticity. M. W. Huggins.

Courses 1 and 10, III Year; 1 hr. lecture per week, both terms.

A study of the stresses and strains in structural materials and members. The topics treated include: members subjected to direct stress, shear stress, and flexural stress, and their resulting deformations; principal stresses; statically indeterminate structures such as continuous and fixed-end beams; the moment-area theorems; photo-elasticity as a method of determining stress intensity.

Reference books: Elements of Strength of Materials—Timoshenko and MacCullough. Applied Elasticity—Timoshenko and Lessels.

34. Fluid Mechanics. B. Etkin.

Course 10, III Year; 1 hr. lecture per week, both terms.

Vector operators; classical equations for perfect fluids, velocity potential, stream function, complex potential. Vorticity, circulation, flow past cylinder with lift. Hydraulic machinery, torque converter. Simple cases of viscous flow.

Text books: Treatise on Hydromechanics—Ramsay. Airfoil and Airscrew Theory—Glauert. Fluid Mechanics—Hunsaker and Rightmire.

35. Cements and Concrete. W. L. Sagar, C. E. Helwig.

Course 1, III Year; 1 hr. lecture per week, both terms.

The work in the first term includes a discussion of the cements used in construction, Portland cement in particular, and a study of the basic principles of concrete making.

In the second term the elements of the theory of reinforced concrete are discussed and examples are considered in the design of slabs, beams, and columns.

Text books: Plain Concrete—Bauer. Chemistry of Cement and Concrete—Lea and Desch. Reinforced Concrete Design—Sutherland and Clifford. Reinforced Concrete Construction, Vol. I—Hool. Elementary Structural Engineering—Urquhart and O'Rourke.

36. Theory of Structures. C. F. Morrison.

Course 1, IV Year; 1 hr. lecture per week, both terms.

The stress analysis of simple span, continuous, and cantilever trusses. Influence lines and index stresses. Truss deflections by analytical and graphical methods. Arches, suspension bridges, and statically indeterminate structures.

Text books: Theory of Simple Structures—Shedd and Vawter. Theory of Modern Steel Structures, Vol. II—Grinter.

38. Mechanics of Materials: General. T. R. Loudon, W. L. Sagar, C. E Helwig.

Course 1, IV Year; 3 hrs. laboratory per week, both terms.

Practice in investigating the elastic and physical properties of iron, steel, concrete, timber, etc., and the use of instruments of precision designed for this purpose.

Reference book: Materials of Construction—Johnson.

39. Foundations and Retaining Walls. T. R. Loudon.

Courses 1 and 4, IV Year; 1 hr. lecture per week, both terms.

A study of the necessity for accurate knowledge of sub-surface conditions as a preliminary to all foundation, retaining wall and dam design serves to introduce this course which deals with methods of sub-surface exploration, and the elements of the designs of

foundation units, bridge piers, and retaining walls of concrete and of steel. Attention is paid to relevant constructional requirements.

40. Soil Mechanics. W. L. Sagar.

Course 1, IV Year; 1 hr. lecture per week, first term.

A subject devoted to those physical and mechanical properties of soils of importance to the engineer, such as compressive and cohesive strengths, internal friction, stability in slopes, compressibility and other deformational characteristics, permeability and moisture retention. The bearing of these properties on the design and construction of engineering works is considered in detail.

Reference books: Engineering Properties of Soil—Hogentogler. Notes on Soil Mechanics and Foundations—Plummer.

41. Reinforced Concrete. C. F. Morrison.

Course 1, IV Year; 1 hr. lecture per week, both terms.

The theory of the strength of reinforced concrete elements, including the beam, the slab, the T-beam, the column, and the girderless floor, is continued in this subject.

The analysis of the monolithic arch by the elastic theory is discussed, and the student is required in the drafting room to apply his knowledge to the design of simple structures.

Reference books: Design of Concrete Structures—Urquhart and O'Rourke. Reinforced Concrete Design—Sutherland and Reese.

42. Structural Design. C. F. Morrison.

Course 4, IV Year; 1 hr. lecture and 3 hrs. problems per week, both terms.

The study of the analysis and design of structural members and structures is continued in this subject. The lectures are supplemented by problems assigned in the drafting room. These problems include the preparation of drawings showing the structural framing and details for various buildings.

43. Structural Design. C. F. Morrison.

Course 1, IV Year; 2 hrs. lectures per week, first term; 1 hr. lecture per week, second term.

Consideration is given to the various types of industrial buildings and other structures, the conditions governing their choice, and the design and details of construction in different materials. Examples in design are worked out in the class and drafting rooms illustrating such points as: economic arrangement of building frames, probable loadings for girders and columns, column eccentricities, wind loading, wind bracing, rigid frames, crane runways, cableways, headframes, tanks and towers.

Reference books: Handbook of Building Construction—Hool and Johnson. Architects' and Builders' Handbook—Kidder-Parker. Steel Mill Buildings—Ketchum.

44. Mechanics of Materials: Concrete. T. R. Loudon, W. L. Sagar, C. E. Helwig.

Course 1, III Year; 2 hrs. laboratory per week, first term.

Fundamentals in the design of sound concrete, including acceptability tests on the materials used in making concrete, experiments to show the effect on the consistency and strength of the concrete caused by variations in the quantities of the ingredients, and the design of an economical mix for a given set of conditions.

Reference books: Design and Control of Concrete Mixtures—Portland Cement Association. Materials Testing—Gilkey, Murphy, Bergman.

46. Structural Engineering. C. F. Morrison.

Courses 3 and 11, IV Year; 2 hrs. lectures per week, first term.

A study is made of various types of industrial buildings and other structures. Methods of analysis and examples in design are considered,involving the use of timber, structural steel,and reinforced concrete.

Reference books: Elementary Structural Engineering—Urquhart and O'Rourke. Steel Mill Buildings—Ketchum. Handbook of building Construction—Hool and Johnson.

47. Structural Design. C. F. Morrison.

Course 4, V Year; 1 hr. lecture and 3 hrs. problems per week, both terms.

In this subject some of the more advanced work in reinforced concrete is studied, including flat slab construction, panels reinforced in two directions, rigid frames and arches. In the drafting room the students apply the principles of structural design to problems in which actual buildings are designed and detailed.

50. Mechanics of Materials: Soils and Highway. W. L. Sagar, C. E. Helwig.

Course 1, IV Year; 3 hrs. laboratory per week, second term.

Experiments relating to the physical properties of rocks such as are used in road building, and bituminous materials as used in road and airport construction. Physical and mechanical characteristics of soils, related to highway and foundation work, are investigated in a series of experiments that provide an introduction to practical Soil Mechanics.

Reference books: Construction of Roads and Pavements—Agg. Specifications—Dept. of Highways, Ontario. Soil Mechanics—Krynine.

APPLIED PHYSICS

70. Applied Physics. V. L. Henderson.

Courses 7 and 11, II Year; 1 hr. lecture per week, both terms.

Correlating the physical principles of light, heat, sound, and vibration with problems in engineering, emphasizing the importance of the analytical approach.

Reference books: College Physics---Perkins. Introduction to Physical Optics—Robertson.

71. Applied Physics Laboratory. V. L. Henderson.

Courses 7 and 11, II Year; 3 hrs. laboratory per week, both terms.

Supplementing subject 70.

72. Optics. K. B. Jackson.

Course 6, III Year; 1 hr. lecture per week, both terms.

Light, geometrical and physical optics, and optical instruments pertaining to chemical engineering.

Text books: Optical Methods of Chemical Analysis—Gibb. Elements of Optics—Valasek.

73. Optics Laboratory. K. B. Jackson.

Course 6, III Year; 3 hrs. laboratory per week, second term.

Supplementing subject 72.

74. Optics. J. T. N. Atkinson.

Courses 8 and 8a, II Year; 1 hr. lecture per week, both terms.

Simple harmonic motion, light geometrical and physical optics, and applications of optics in chemistry and metallurgy.

75. Applied Physics. E. L. Dodington.

Course 1, II Year; 1 hr. lecture per week, both terms.

Correlating the physical principles of light, heat, sound and vibration with problems in engineering, emphasizing the importance of the analytical approach.

Reference book: Handbook of Engineering Fundamentals—Eshbach.

76. Applied Physics Laboratory. E. L. Dodington.

Course 1, II Year; 3 hrs. laboratory per week, both terms

Supplementing subject 75.

77. Photography. K. B. Jackson.

Course 4, II Year; 1 hr. lecture per week, first term.

The principles of photography, photographic equipment, materials, and processes, with special reference to architectural photography.

Reference books: Elementary Photography—Quarles. Fundamentals of Photography—Boucher.

78. Photography Laboratory. K. B. Jackson.

Course 4, II Year; 3 hr. laboratory per week, first term.

Supplementing subject 77.

79. Photometry. K. B. Jackson, E. L. Dodington.

Courses 5c, 5i, and 5s, III Year; 1 hr. lecture per week, second term.

Photometry, and the use of photography as a scientific implement.

80. Photometry. E. L. Dodington.

Courses 5c, 5s, and 5i, III Year; 3 hrs. laboratory per week, second term.

Supplementing subject 79.

81. Photographic Surveying. K. B. Jackson.

Course 1, III Year; 1 hr. lecture per week, first term.

An introduction to the methods and applications of terrestrial and aerial photographic surveying.

82. Acoustics. V. L. Henderson.

Course 7, IV Year; 2 hrs. lectures per week, second term.

This subject deals with the properties of acoustical elements, particularly with their application in electrical sound systems.

Reference books: Elements of Acoustical Engineering—Olson. Applied Acoustics—Olson and Massa.

83. Acoustics Laboratory. V. L. Henderson, H. A. Harvey, K. N. Stevens.

Course 7, IV Year; 3 hrs. laboratory alternate weeks, second term.

Supplementing course 82.

85. Light and Acoustics. V. L. Henderson.

Course 4, III Year; 1 hr. lecture per week, both terms.

Production and propagation of sound, the control of reverberation, sound transmission through partitions, and vibration insulation; and an elementary course in the production of light, and the measurement of light and electricity, in preparation for subject 87.

Reference book: Acoustics of Buildings—Watson.

86. Light and Acoustics Laboratory. V. L. Henderson.

Course 4, III Year; 2 hrs. laboratory per week, both terms.

Problems and experiments on the nature and production of light, the spectral and spacial distribution of sources.

Problems, mathematical and graphical, on the control of sound.

Laboratory experiments on reverberation, transmission and other acoustical phenomena.

87. Illumination Design. E. L. Dodington.

Course 4, IV Year; 1 hr. lecture per week, both terms.

Control of light distribution, the computation of illumination and brightness, and the design of lighting installations for public and private buildings.

88. Illumination Design Laboratory. E. L. Dodington.

Course 4, IV Year; 1 hr. laboratory per week, both terms.

Supplementing subject 87. By co-operation with the staff of the School of Architecture, problems in lighting design and acoustics will form a part of certain problems in architectural design in subjects 123, 124, and 125.

89. Architectural Acoustics. V. L. Henderson.

Course 5i, IV Year; 1 hr. lecture per week, first term; 3 hrs lectures per week, second term.

Design of buildings for good acoustics, the calculation and measurement of the acoustical properties of buildings and materials, and the treatment of buildings to improve their acoustical properties and to control the nuisance of noise.

90. Architectural Acoustics Laboratory. V. L. Henderson.

Course 5i, IV Year; 3 hrs. laboratory per week, first term; 9 hrs. laboratory per week, second term.

Supplementing subject 89.

91. Light and Acoustics. V. L. Henderson.

Course 11, IV Year; 1 hr. lecture per week, both terms.

The production of light and the engineering principles underlying its utilization.

The generation and control of sound.

92. Light and Acoustics. V. L. Henderson.

Course 11, IV Year; 1½ hrs. laboratory per week, both terms.

A laboratory course supplementing course 91.

93. Illumination. V. L. Henderson.

Course 7, IV Year; 2 hr. lectures per week, second term.

Illuminating Engineering dealing with the production and measurement of light and colour, and the theory and design of lighting equipment and installations.

Reference books: Scientific Basis of Illuminating Engineering—Moon. Electrical Illumination—Kraehenbuehl.

94. Illumination Laboratory. V. L. Henderson, H. A. Harvey, K. N. Stevens.

Course 7, IV Year; 3 hrs. laboratory per week second term.

Supplementing subject 93.

95. Photometry and Illumination Design. K. B. Jackson, V. L. Henderson.

Course 5i, IV Year; 2 hrs. lectures per week, both terms.

Measurements of luminous intensity, luminous flux, illumination, brightness, reflection, transmission, absorption, diffusion, and colour by visual and physical methods; and on the design and application of illuminating engineering equipment.

96. Photometry and Illumination Design Laboratory. K. B. Jackson. V. L. Henderson.

Course 5i, IV Year; 6 hrs. laboratory per week, both terms.

Supplementing subject 95.

97. Acoustics. V. L. Henderson.

Courses 5c and 5s, IV Year ; 1 hr. lecture per week, first term.

Acoustics of electrical sound systems; including sound waves, hearing, the mechanical-electrical-acoustical analogy, microphones, loud speakers, etc.

Reference books: Elements of Acoustical Engineering—Olson. Applied Acoustics—Olson and Massa.

99. Vibration Engineering. V. L. Henderson.

Course 5r, IV Year; 1 hr. lecture per week, both terms.

Vibrating systems with one degree of freedom. Electrical analogues and impedance methods. Systems with more than one degree of freedom. Application to machines and structures. Instrumental methods.

100. Vibration Laboratory. V. L. Henderson,

Course 5r, IV Year; 3 hrs. laboratory per week, both terms.

A series of experiments designed to give familiarity with the nature of vibrating systems and the causes, measurement, and control of vibration in engineering problems.

ARCHITECTURE

110. History of Architecture. Anthony Adamson.

Course 4, I Year; 1 hr. lecture per week, both terms.

An historical research project is carried out in the drafting room.

Development of architecture and structural methods in Ancient Egypt, Classical Greece, the Roman Empire, the Byzantine Empire.

Reference books: Egyptian Architecture as Cultural Expression —Baldwin Smith. Handbook of Greek and Roman Architecture—D. S. Robertson. Architecture Through the Ages—Talbot Hamlin.

111. History of Architecture. Anthony Adamson.

Course 4, II Year; 1 hr. lecture per week, both terms: An historical research project is carried out in the drafting room.

Development of European architecture and structural methods from the time of Constantine the Great till the end of the Gothic period.

Reference books: Mediaeval Architecture—A. K. Porter. Gothic Architecture in England—Francis Bond. Architecture Through the Ages—Talbot Hamlin.

112. History of Architecture A. H. H. Madill.

Course 4, III Year; 1 hr. lecture per week, first term.

An illustrated course of lectures on the architecture of the Renaissance in Italy and France with special reference to the work of the important architects.

Reference books: Architecture of the Renaissance in Italy—Anderson and Stratton. The Architecture of the Renaissance in France, Vols. I and II—W. H. Ward. Architecture Through the Ages—Hamlin.

113. History of Architecture B. E. R. Arthur.

Course IV. III Year.

This course is divided into two parts.

a. 1 hr. lecture week, first term. An illustrated series of lectures dealing with Renaissance buildings in general but with emphasis on the development of the English house. For that purpose two lectures are given at the beginning of the course on the Mediaeval house. The social history of the period 1500-1900 is a prescribed reading course.

Reference books: A History of Renaissance Architecture in England—Reginald Blomfield. The Growth of the English House—J. A. Gotch. The History of the English House—N. Lloyd. The Gothic Revival—K. Clark. The Architecture of Humanism—G. Scott. British Architects and Craftsmen—S. Sitwell. English Social History—G. M. Trevelyan.

b. 1 hr. lecture per week, both terms. The modern development in Architecture is traced from its roots in the Industrial Revolution of the 19th century to the present time. Examples are studied from the U.S. and Europe. In the second term, as a part of this course, several lectures are given on the subject of industrial design.

Reference books: Space, Time and Architecture—S. Giedion. Modern Building—W. C. Behrendt. Pioneers of the Modern Movement—N. Pevsner. The Architecture of H. H. Richardson and His Times—H. H. Hitchcock. Life of William Morris—J. W. Mackail. Design This Day—W. D. Teague. Art and Industry—Herbert Read.

115. Functional Requirements of Buildings. J. A. Murray.

Course 4, III Year; 1 hr. lecture per week, both terms.

The principles underlying the planning of complex buildings as for example, churches, theatres, office buildings, etc., are discussed in detail. The course is a continuation of the work commenced in Theory of Architectural Planning in the Second Year. Practising architects who specialize in particular types of buildings are invited to give lectures in the course.

116. Garden Design. H. B. Dunington-Grubb.

Course 4, III Year; Special lectures, first term.

In this subject the historical development of Garden Design is traced from earliest times; the study of sites; the influence of topography, orientation, planting, access, etc., on the problems of design; site planning; the location of buildings; the solution of an actual problem on a typical site.

117. Town Planning. A. P. C. Adamson.

Course 4, V Year; 1 hr. per week, both terms.

This course is divided into two parts.

a. The history of urbanism and the development of town planning theory from historic times to the present day. An essay is assigned in this work.

Reference books: Culture of Cities—Mumford. Space, Time and Architecture —Giedion. The New City—Hilbersheimer.

b. Town planning practice in Canada with studies of contemporary European and American examples.

Reference books: Local Planning and Administration—Segoe. Action for Cities—A.S.P.O. "Planning the Small American City"—Black. Town Planning Reports.

118. Elements of Architectural Form. E. R. Arthur.

Course 4, I Year; 1 hr. lecture per week, both terms.

Introductory lectures leading to planning and design in later years. Form, scale and proportion are studied. Simple domestic plans are discussed, and elements of design are examined in relation to actual buildings. These elements include windows, doors, roofs, texture, materials, etc. Reading is prescribed and an essay is assigned.

Reference books: Theory and Elements of Architecture, Vol. 1, Part I—Robert Atkinson and Hope Bagenal. Design—P. E. Nobbs. Design this Day—W. D. Teague. On being an Architect—Lescaze. The Englishman Builds---Ralph Tubbs.

119. History of Painting. G. S. Vickers.

Course 4, IV Year; 1 hr. lecture per week, both terms.

An historical survey of painting as mural decoration. A detailed study of classic and contemporary painting.

120. History of Sculpture. G. S. Vickers.

Course 4, V Year; 1 hr. lecture per week, first term.

An historical survey of the function of sculpture with particular stress upon the renaissance of the art in the present century.

121. Architectural Drawing. H. H. Madill, W. E. Carswell, S. R. Kent, E. Vichos, J. Banigan.

Course 4, I Year; 15 hrs. studio per week, both terms.

The course commences with instruction in drafting and lettering. It becomes the drafting room component of a number of subjects in the curriculum, including mathematics, applied mechanics, details of elementary construction, isometric and perspective drawing. The course includes introductory work in architectural design.

Architectural Design.

122. Course 4, II Year; 15 hrs. per week, first term, 20 hrs. per week, second term.
123. Course 4, III Year; 17 hrs. per week, both terms.
124. Course 4, IV Year; 20 hrs. per week, both terms.
125. Course 4, V Year; 25 hrs. per week, both terms.

E. R. Arthur, R. J. K. Barker, J. A. Murray, G. Englesmith, H. Fliess, J. B. Langley, W. J. McBain, H. Owen, J. C. Parkin, W. Shulman, C. R. Worsley.

An integrated programme of design problems continuous through four years of the course. During this programme a series of problems involving residential, commercial, institutional and industrial buildings are assigned, beginning with simple buildings in the second year and proceeding to buildings of increasing complexity in the ensuing years. Interior design, furniture and alterations all find a place in the programme. Problems in industrial design and problems in town planning are studied. One problem is developed in working drawings and, throughout the programme, working details are studied of selected elements of the designs.

In the fifth year the student is required to present as the major problem a design thesis, the subject for which is the student's own choice approved by the staff. This problem involves the study of an important building from the sketch stage to working drawings. A report on the building and specification work is required. Work on this long problem is interrupted by sketch problems of one or more days duration. In addition, a written thesis of 5,000 words on a topic approved by the staff is required.

In all years a number of day designs is included to train the student in quick thinking, imaginative conception and ability in sketch presentation. Three dimensional models are required in most

important problems. Individual instruction is given in the drafting room and final drawings are criticized at the conclusion of each problem. Frequently, actual proposed buildings form the basis for problems, and original research is part of the design approach.

126. Materials and Methods of Construction. W. G. Raymore.

Course 4, II Year; 1 hr. lecture per week, both terms.

The course extends the study of building methods and materials commenced in the first year, with a more intensive investigation of footings, foundations, waterproofing, masonry walls, windows, doors, stairs, chimneys, wood, brick, hollow masonry units, lime, portland cement, mortar, and concrete.

This study is applied in the drafting room in the preparation of details from the student's design problems, and in working drawings for a small residence.

A report will be prepared and presented by each student on an approved topic relating to building construction.

Reference books: National Building Code—Toronto Building By-Law. Materials and Methods of Architectural Construction—Gay and Parker. Building Construction—Huntington. Architects' Handbook—Kidder-Parker.

127. Materials and Methods of Construction. W. G. Raymore.

Course 4, III Year; 1 hr. lecture per week, both terms.

A consideration of the fundamental requirements of the elements of structures, such as foundations, walls, floors, roofs. Analysis of the characteristics of frame, ordinary, heavy timber, steel, and reinforced concrete construction. Structural requirements according to occupancy and fire resistance. Prefabrication. Modular construction. Drafting room problems: preparation of details from the student's design problems, and working drawings of a building of moderate size.

A report will be prepared and presented by each student on an approved topic relating to the course.

Reference books: National Building Code—Toronto Building By-law. Architectural Construction—Crane.

128. Theory of Architectural Planning. J. A. Murray.

Course 4, II Year; 1 hr. lecture per week, both terms.

This course is considered under two headings:

a. An introduction to modern architecture—Consideration of technical and social factors shaping buildings today, and an introductory analysis of aesthetic principles in contemporary design. Significant modern buildings are analysed for planning and design.

b. An analysis of the general principles of planning. The development of a planning method. Problems of circulation, building services, fenestration, orientation, etc., are studied. Actual planning problems of simple buildings—as for example, banks, libraries, are dealt with as an aid to problems set in architectural design and as a preliminary to the study of more complex buildings in the following year. A series of lectures are devoted to the problems of house planning and design.

Reference books: The Modern House—F. R. S. Yorke. Plan Requirements of Modern Building—V. O. Rees. On Being An Architect—Lescaze. What is Modern Architecture—Museum of Modern Art. Modern Architecture—J. M. Richards. A Key to Modern Architecture—F. R. S. Yorke; Colin Penn.

129. Draftsmanship and Presentation. R. J. K. Barker.

Course 4, II Year; 1 hr. lecture per week, first term.

This series is given in conjunction with studio work in architectural design, and deals primarily with the making of presentation drawings. Drafting technique is discussed in detail, with a general introduction to the rudiments of rendering and sheet arrangement. Student drawings are criticized in class.

Reference books: The study of Architectural Design—John F. Harbeson. Drafting Room Practice—Eugene Clute.

130. Housing. E. R. Arthur, R. J. K. Barker, J. A. Murray.

Course 4, IV Year; 1 hr. lecture per week, both terms.

This series deals with housing for sale or rent, but is concerned mainly with the lower income groups. The study includes financing, planning, land acquisition and housing legislation in Canada, the United States and England and cooperative housing. The lectures are illustrated.

Reference books: Europe Rehoused—Elizabeth Denby. Modern Housing—Catherine Bauer. Report No. 4 of the committee on Housing and Community Planning. The Seven Myths of Housing—Nathan Straus.

131. Elements of Design and Rendering. W. E. Carswell, J. A. Hall.

Course 4, I Year; 2 hrs. per week, both terms.

Drawing from observed objects, freehand perspective, rendering in pencil, chalk and water colour. Abstract composition.

132. Elements of Design and Rendering. W. E. Carswell, J. A. Hall.

Course 4, II Year; 2 hrs. per week, both terms.

Composition of observed and imagined objects. Investigations of the use of inks, chalk, tempra, water colour and their application to architectural rendering. Instruction is also given in rendering in the drafting room as architectural design problems approach completion.

Students are required to attend a course in field sketching in the vicinity of Toronto the second week of October.

133. Elements of Design and Rendering. W. E. Carswell, J. A. Hall.
Course 4, III Year; 2 hrs. per week, both terms.
Drawing from still life and from life. All over patterns. Investigation of mixed mediums. The application of the elements of design in 3 dimensions, as work in wood and other materials. Instruction is also given in rendering in the drafting room as architectural design problems approach completion.
Students are required to attend a course in field sketching at the University Survey Camp during the last week in September.
Students will report at the Camp on the date shown on page 5.

134. Elements of Design and Rendering. W. E. Carswell, J. A. Hall.
Course 4, IV Year.
Students are required to attend a course in field sketching at the University Survey Camp during the last week in September.
Students will report at the Camp on the date shown on page 5.

136. Colour. W. E. Carswell.
Course 4, II Year; 1 hr. lecture per week, $1\frac{1}{2}$ terms.
This study assists the student in his appreciation of colour as an element in architectural design. Use of modern colour knowledge to obtain any required emotional or optical effect and to understand colour schemes in interior decoration. The systems of Munsell and Ostwald are studied.

137. Model Making. F. Coates.
Course 4, II Year; 2 hrs. per week, both terms.
The techniques of making scale models of architectural forms and the entourage of buildings. The model of a design by the student is completed by the end of the year. In the succeeding year sketch models are required for all important problems in architectural design.

138. Building Materials: Wood. J. W. B. Sisam.
Course 4, IV Year; 1 hr. laboratory per week, both terms.
Laboratory work on the economic woods used in building; their properties and identification.

139. Town Planning Theory. J. A. Murray.
Course 4, IV Year; 1 hr. per week, first term.
a. A study of underlying principles of regional planning.
b. Analysis of the modern city; dwelling, work, recreation, transportation; growth and form of cities; civic appearances; city redevelopment.
c. A study of the neighbourhood unit.

d. Technique of planning residential communities, location, size subdivision, street layout, utilities, open spaces, community facilities, etc.

This work is supplemented by actual problems in neighbourhood planning in the draughting rooms.

Reference books: Can Our Cities Survive—Government. The City—Saarinen. Town Planning—Sharpe. TVA—Julian Huxley. Regional Planning—National Resources Planning Board. The Valley and its People—R. C. Duffus, Charles Knetch.

140. Building Construction. H. H. Madill.

Course 4, I Year; 1 hr. lecture per week, second term.

Instruction is given in elementary construction using common building materials and in the detailing of doors, windows, roofs, fireplaces, stairs, etc.

Reference book: Architectural Graphic Standards—Ramsey and Sleeper.

141. Materials and Methods of Construction. H. H. Madill, W. G. Raymore.

Course 4, IV Year, 1 hr. lecture per week, both terms.

A continuation of the study of materials of construction and their use in buildings, with particular application to finishing materials.

In the drafting room, working details will be prepared from the student's design problems.

A small exhibition room has been set aside in which examples of modern materials and devices are displayed together with a file of catalogues.

Reference books: Building Construction—Huntington. Materials and Methods of Architectural Construction—Gay and Parker. National Building Code.

142. Sanitary Science. H. H. Madill.

Course 4, IV Year; 1 hr. lecture per week, both terms.

Modern plumbing, its design and installation, drainage, sewage disposal and water supply.

Reference books: Mechanical and Electrical Equipment for Buildings—Gay and Fawcett.

143. Professional Practice. H. H. Madill.

Course 4, V Year; 1 hr. lecture per week, both terms.

This subject is designed to give an understanding of the professional character of the practice of architecture. In it are discussed the ethical, business, and legal relations of the architect to clients, contractors, craftsmen, consultants and the professional associations. The customs of office practice are also discussed.

Reference books: Architectural Practice and Procedure—H. H. Turner. The Architects Law Manual—C. H. Blake. The Law of Architecture and Building—C. H. Blake. Handbook of Architectural Practice A.I.A. Contract Forms of R.A.I.C. Engineering Law—Laidlaw and Young.

144. Heating and Air Conditioning. F. G. Ewens.

Course 4, V Year; 1 hr. lecture per week, both terms.

Instruction in methods of heat transfer, principles of design of steam, hot water and warm air heating systems, the use of the psychrometric chart, and design of ventilation and air conditioning systems.

Textbook: Heating and Air Conditioning—Allen, Walker, and James.

Reference Book: Guide of the American Society of Heating and Ventilating Engineers.

145. Architectural Economics. J. A. Murray.

Course 4, V Year; 1 hr. lecture per week, first term.

Instruction in the various methods of preparing estimates, together with practical work in taking off quantities. Comparative costs of various types of materials and construction.

Building finance, revenue, and expenditure are also discussed.

146. Specifications. W. G. Raymore.

Course 4, V Year; 1 hr. lecture per week, second term.

Characteristics of a well-written specification. Sources of authority for quality and performance. Specification by trades.

Reference books: Architectural Specifications—Sleeper. Architect's Specifications—Goldsmith.

147. Measured Drawings. E. R. Arthur.

Course 4, III Year.

Each student is required to submit, not later than the day of registration, a set of measured drawings of an existing building, along with the record of measurements and sketches neatly arranged in a note book. A coloured sketch of the building is also required. The subjects must be approved before measuring is begun. The study is marked as a separate subject, on the same basis as term work.

148. Aesthetics. H. R. MacCallum.

Course 4, V Year; 1 hr. lecture per week, both terms.

An historical and critical survey of the principal types of aesthetic theory.

ASSAYING, MINING, AND ORE DRESSING

The work in Mining is designed to give a thorough training in the underlying principles of Mining in its various branches, including exploration, development, and production. Special attention is

paid to the practical and business aspects of these subjects.

The teaching of assaying has a two-fold function. The first is to give the student a working knowledge of the practice of the art, so that he can earn money as an assayer, upon graduation, and use this as a stepping-stone to other positions. The second is to use the assaying laboratories for the training of students in certain important phases of engineering methods. The size of the apparatus, the completeness of the processes in short intervals of time, the extreme accuracy of results when so desired, the relation of the extent of error to time and method, the similarity of the academic laboratory to the field laboratory—all these permit an unrivalled opportunity for driving home much broad engineering philosophy. The assaying processes and apparatus lend themselves peculiarly well to the development of a proper perspective in regard to errors and accuracy in measurements.

160. Assaying. M. Hewer.

Courses 2, 8, and 9, III Year; 1 hr. lecture per week, both terms.

Theory and practice of fire assaying. Emphasis is laid not only upon the principles of chemistry, metallurgy and sampling involved, but also upon the errors inherent in operators as well as in methods.

References: Manual of Fire Assaying—Fulton and Sharwood. Textbook of Fire Assaying—Bugbee. Fire Assaying—Shepherd and Dietrich.

161. Assaying Laboratory.

Courses 2, 8, and 9, III Year; 3 hrs. laboratory per week, both terms.

Determination of precious metals. Some lecture instruction is given. Scorification and crucible assays of ores, pure and impure; and of milling and metallurgical products, including cyanide solutions. Buckboard practice on ores with metallics is given. Students are expected to do their later assays with despatch and a reasonable degree of accuracy.

164. Assaying Laboratory. M. Hewer.

Course 8a, III Year; 3 hrs. laboratory per week, first six laboratory periods of first term; two lecture periods of 2 hrs. each for the first two Mondays of the session.

An introductory laboratory subject for ceramic engineers. Some lecture instruction is given. An abbreviation of subjects 160 and 161.

165. Mining Laboratory. The Staff in Mining Engineering.

Courses 2 and 9, I Year; 2 hrs. laboratory per week, first term.

A laboratory subject including some lectures, being an introduction to certain mining and milling machinery and methods.

166. Mining Laboratory. R. E. Barrett.
Course 2, IV Year; 6 hrs. laboratory per week, second term.
Course 9, IV Year; 3 hrs. laboratory per week, second term.
Special mining problems.

167. Mining. R. E. Barrett.
Courses 2 and 9, II Year; 1 hr. lecture per week, first term. An introductory course of lectures.

168. Mining. S. E. Wolfe.
Course 8, II Year; 1 hr. lecture per week, both terms.
Principles of Mining.

170. Mining. R. E. Barrett.
Courses 2 and 9, III Year; 1 hr. lecture per week, both terms. Principles of mining.

171. Mining. R. E. Barrett.
Courses 2 and 9, IV Year; 2 hrs. lectures per week, second term.
Special problems, estimates, reports.

172. Mine Management. R. E. Barrett.
Courses 2 and 9, IV Year; 2 hrs. lectures per week, first term.
Consideration of organization, efficiency methods of operation, some of the business aspects of mining and pays particular attention to labour relations.

173. Mine Ventilation and Allied Problems. G. R. Lord.
Course 2, IV Year; 2 hrs. lectures per week, first term.
Ventilation problems in Canadian mines, including the use of ventilation equipment, selection of fans, testing equipment, ventilation studies, the silicosis problem, fire control, etc.

174. Mine Ventilation Laboratory. The Staffs in Mining and Mechanical Engineering.
Course 2, IV Year; 3 hrs. laboratory per week, first term.
Experiments in the laboratories and problems in the study room to give the student some practice in the use of ventilation test equipment, and the solution of ventilation problems.

175. Ore Dressing. S. E. Wolfe.
Courses 2 and 8, III Year; 2 hrs. lectures per week, second term.
The general principles of ore dressing.

176. Ore Dressing Laboratory. S. E. Wolfe.
Courses 2 and 8, III Year; 6 continuous hrs. laboratory per week, second term.
Work with crushing machinery, principles of crushing and grading, screen analyses, concentration with gravity separation apparatus, etc.

177. Ore Dressing. S. E. Wolfe.
Courses 2 and 8, IV Year; 1 hr. lecture per week, both terms.
Subject 175 continued, study of flow sheets, and special problems.

178. Ore Dressing. S. E. Wolfe.
Courses 2 and 8, IV Year; 6 continuous hrs. laboratory per week, first term.
Advanced work with ore dressing appliances, ore testing, and check mill runs.

180. Ore Dressing Laboratory. S. E. Wolfe.
Course 8a, IV Year; 3 hrs. laboratory per week, both terms.
Principles of sampling, crushing, and grading, screen analyses, concentration with gravity separation apparatus, flotation, ore testing, etc.

181. Principles of Mineral Dressing. S. E. Wolfe.
Courses 2, 8 and 9, III Year; Course 8a, IV Year; 2 hrs. lectures per week, first term.
Mineral dressing methods involve a study of the laws governing the phenomena of surface tension, capillarity, and colloidal solutions, in addition to those of hydrostatics and certain phases of hydraulics. This is embodied in a special course of lectures in conjunction with laboratory work in the ore dressing laboratory.

182. Theory of Measurements. S. E. Wolfe.
Courses 2 and 9, II Year; 1 hr. lecture per week, first term.
This title is not an entirely suitable one for this subject because it is generally applied to a study of the philosophy of extremely accurate measurements. The mining engineer has to continually make satisfactory use of measurements with a wide range of inaccuracy. This subject deals with the philosophy underlying the causes of these errors and the practical application of such approximations. The opportunity is taken in these lectures to deal with the subject of illustrating measurements by graphs.

183. Mining Laboratory. R. E. Barrett.
Course 2, III Year; 3 hrs. laboratory per week, second term.
A laboratory subject consisting of short experimental problems. It is designed to develop the individual student's initiative by his systematic observance of the effects of variables.

184. Summer Letters. R. E. Barrett.
Course 2, III Year.
A series of letters written during the summer vacation, dealing with various aspects of a mining engineer's work. These are intended to direct and help the student's powers of observation, analysis, and criticism, as well as being exercises in the art of lucid technical expression.
Special instructions will be issued in connection with these letters.

185. Summer Essays. R. E. Barrett.
Course 2, IV Year.
Special instructions will be given in connection with this work.

186. Problems and Seminar. The Staff in Mining Engineering.
Course 2, II, III, and IV Years; Course 9, II Year; 2 hrs. seminar per week, first term.
A seminar in which the students discuss technical and business problems, under their own supervision. A portion of the time is given to guest speakers on special subjects.

ASTRONOMY AND GEODESY

200. Practical Astronomy. G. T. Horton.
Course 1, II Year; 2 hrs. lectures per week, second term.
Practical determination of time, latitude, and azimuth, by methods adapted to the use of the surveyor's transit. The subject will be designed to enable the student to carry out these observations at the Summer Survey Camp.
Text books: Nautical Almanac, for current year. Practical Astronomy for Engineers—G. T. Horton.

201. Astronomy and Geodesy. J. W. Melson, O. J. Marshall.
Course 1, III Year; 2 hrs. lectures per week, second term.
Determination of time, latitude, longitude, and azimuth, by methods adapted to the use of the surveyor's transit and the sextant. It is designed to fulfil the requirements of the final examinations for Ontario and Dominion Land Surveyors.
In Geodesy an account is given of the principles and methods of a secondary triangulation survey, also of the principles involved in the North-west system of survey.
Text books: Practical Astronomy as applied to Geodesy and Navigation—Doolittle. Notes on Practical Astronomy and Geodesy. Nautical Almanac.

BOTANY

210. Properties of Living Matter. G. H. Duff.
Course 5r, III Year; 2 hrs. lectures per week, both terms.
Cellular and protoplasmic organization from both the structural and functional points of view.

211. Low Temperature Physiology. G. H. Duff.
Course 5r, IV Year; 1 hr. lecture per week, both terms.
Cryophilic organisms and the physiological and biochemical effects of low temperature.

212. Low Temperature Physiology Laboratory. G. H. Duff.
Course 5r, IV Year; 3 hrs. laboratory per week, both terms.
A laboratory subject supplementing subject 211.

CIVIL ENGINEERING

214. Sanitary Engineering. A. E. Berry.

Course 1, IV Year; 1 hr. lecture per week, both terms.

Problems of water supply, sewerage, and municipal sanitation as viewed by the engineer. This subject includes the design of water distribution and sewer systems, as well as water and sewage treatment works.

215. Sanitary Engineering Laboratory. A. E. Berry, M. W. Huggins.

Course 1, IV Year; 3 hrs. per week, both terms.

Problems on the design of water distribution and sewer systems as well as water and sewage treatment works.

216. Municipal Administration. A. E. Berry.

Course 1, IV Year; 1 hr. lecture per week, second term.

Municipal government, assessment and taxation, municipal finance, public utilities, expropriation, annexation problems, town planning, local improvement, and other laws relating to municipalities. Problems are assigned, from assumed data and from material secured in the field, to be worked out in the drafting room under subject 301.

217. Transportation Engineering. W. M. Treadgold, W. L. Sagar.

Course 1, IV Year; 2 hrs. lectures per week, both terms.

Principles governing the location, design, and construction of railways, highways, airports, and inland waterways.

CHEMISTRY AND CHEMICAL ENGINEERING

221. Chemistry. The Staff in Chemical Engineering.

Courses 1, 2, 3, 5, 6, 7, 8, 8a, 9, 10, and 11, I Year; 2 hrs. lectures per week, both terms.

Advanced chemical theory, with industrial and engineering applications.

222. Chemical Laboratory. L. J. Rogers, E. A. Smith, R. R. McLaughlin, D. J. Le Roy.

Courses 1, 3, 7 and 11, I Year; 6 hrs. laboratory per week, one term.

Courses 2, 8 and 9, I Year; 6 hrs. laboratory per week, both terms.

Courses 6 and 8a, I Year; 9 hrs. laboratory per week, one term; 6 hrs. laboratory per week, other term.

Courses 5 and 10, I Year; 3 hrs. laboratory per week, both terms.

Quantitative experiments illustrating the use of the sensitive balance, and confirming the fundamental laws of chemistry; qualitative inorganic analysis; quantitative analysis.

223. Inorganic Chemistry. C. P. Brockett.

Courses 6, 8 and 8a, II Year; 1 hr. lecture per week, both terms.

A continuation of subject 221.

225. Analytical Chemistry. L. J. Rogers.

Courses 2, 8 and 9, III Year; 1 hr. lecture per week, both terms.

Principles of chemical analysis; select gravimetric and volumetric methods; technical analysis.

226. Engineering Chemistry. The Staff in Chemical Engineering.
Courses 1, 3, 7 and 11, II Year; 1 hr. lecture per week, both terms.
Water-softening, corrosion, petroleum, rubber, and plastics.

227. Analytical Chemistry Laboratory. E. A. Smith.
Courses 2 and 9, II Year; 3 hrs. laboratory per week, second term.
Gravimetric determination of metals and acids, with elementary volumetric analysis, accompanied by lectures.

228. Analytical Chemistry Laboratory. L. J. Rogers.
Courses 8 and 8a, II Year; 9 hrs. laboratory per week, both terms.
Comprising gravimetric and volumetric methods, acidimetry and alkalimetry.
Text books: Analytical Chemistry, Vol. II—Treadwell-Hall. Qualitative Chemical Analysis—A. A. Noyes.

229. Chemical Laboratory. L. J. Rogers, F. E. Beamish, R. R. McLaughlin, E. A. Smith.
Course 6, II Year.
This subject will commence September 2, and will continue until September 20, 1947, the entire working week being spent in the laboratory on quantitative analysis.

230. Industrial Chemistry. E. A. Smith.
Courses 6 and 8a, II Year; 1 hr. lecture per week, first term; 2 hrs. lectures per week, second term.
Course 11, II Year; 1 hr. lecture per week, both terms.
Manufacture of acids, alkalies, and inorganic chemicals; water-softening, corrosion, explosives.

232. Industrial Chemistry and Technical Analysis. E. A. Smith.
Course 6, II Year; 11 hrs. laboratory per week, first term.
An introductory laboratory subject in industrial chemistry containing experiments on petroleum products, fertilizers, etc., colorimetric determination of hydrogen-ion, stoichiometric calculations, instruction in glass-blowing.

234. Organic Chemistry. J. G. Breckenridge.
Course 6, II Year; 2 hrs. lectures per week, both terms.
An introductory course in organic chemistry, with emphasis on reaction conditions and yields, and the industrial significance of certain compounds and reactions.

235. Organic Chemical Laboratory. R. R. McLaughlin, J. G. Breckenridge.
Course 6, II Year; 10 hrs. laboratory per week, second term.
A laboratory subject accompanying lecture subject 234.

236. Physical Chemistry. D. J. Le Roy.

Courses 6, 8, and 8a, II Year; Course 9, III Year; 2 hrs. lectures per week, both terms.

Principles of Phase Rule; introduction to chemical thermodynamics and theory of solutions.

237. Analytical Chemistry Laboratory. L. J. Rogers.

Courses 2 and 9, III Year; 4 hrs. laboratory per week, first term; 3 hrs. per week, second term.

Technical analysis of ores and furnace products.

238. Industrial Chemistry and Chemical Engineering.

Industrial Chemistry. E. A. Smith.

Course 6, III Year; 13½ hrs. laboratory per week, second term.

A continuation of subject 232, containing experimental work on coal, petroleum, illuminating gas, sugars, starch, etc., potentiometric determination of hydrogen-ion, and stoichiometric calculations.

Chemical Engineering. Staff in Chemical Engineering.

Course 6, III Year; 30 hrs. laboratory.

Experiments in Chemical Engineering introductory to subject 251.

239. Metallurgical Theory. W. C. Macdonald.

Course 8, III Year; 2 hrs. lectures per week, both terms.

A course for metallurgy students dealing particularly with Chemical Thermodynamics as applied to metallurgical reactions.

240. Chemical Theory. R. R. McLaughlin, W. C. Macdonald.

Courses 6 and 8a, III Year; 2 hrs. lectures per week, second term

Chemical theory.

241. Industrial Chemistry. E. A. Smith.

Course 6, III Year; III Year Honour Chemistry (Arts); 1 hr. lecture per week, both terms.

Petroleum and its products, coal tar and its products, fats, oils, soap, sugar, starch, fermentation industries, etc.

242. Chemical Engineering. W. C. Macdonald, G. W. Minard.

Courses 6 and 8a, III Year; 2 hrs. lectures per week, first term.

The theory and practice of heat transfer, evaporation, filtration, and other industrial operations.

Text book: Elements of Chemical Engineering — Badger and McCabe.

244. Organic Chemistry. R. R. McLaughlin, J. G. Breckenridge.

Course 6, III Year; 2 hrs. lectures per week, both terms.

A continuation of subject 234.

245. Organic Chemical Laboratory. R. R. McLaughlin, J. G. Breckenridge.
Course 6, III Year; 12 hrs. laboratory per week, first term.
A laboratory subject accompanying lecture subject 244.

246. Electrochemistry. F. E. W. Wetmore.
Courses 6 and 8, III Year; 16 lectures, first term.
Elementary electrochemistry.

247. Electrochemistry Laboratory. F. E. W. Wetmore.
Course 6, III Year; 18 hrs., first term.
Course 8, III Year; 3 hrs. per week, first term.
Quantitative measurements to accompany subject 246.

248. Chemical Engineering Thermodynamics. W. C. Macdonald.
Course 6, IV Year; 1 hr. lecture per week, both terms.
Chemical thermodynamics, dealing with problems in chemical engineering.

249. Organic Chemistry. R. R. McLaughlin, J. G. Breckenridge.
Course 6, IV Year; 1 hr. lecture per week, both terms.
A continuation of subjects 234 and 244.

250. Organic Chemistry. A. J. Poynton.
Courses 2, 5, 8a and 9, II Year; 1 hr. lecture per week, both terms.
General reactions and methods of synthesis of carbon compounds.
Text book: Chemistry of Organic Compounds—Conant.

251. Chemical Engineering and Organic Chemistry. Staff in Chemical Engineering.
Course 6, IV Year; 15 hrs. laboratory per week, first term.
This subject is a continuation of subjects 238 and 245, and includes experiments involving quantitative measurements on chemical engineering equipment, production of organic compounds using small-scale pilot-plant apparatus, and certain experiments in the fields of physical, analytical, and organic chemistry.

252. Chemical Engineering Problems. W. C. Macdonald, G. W. Minard.
Course 6, IV Year; 2 hrs. laboratory per week, second term.
Calculations in connection with various problems in chemical engineering.

253. Chemical Engineering. G. W. Minard.
Course 6, IV Year; 1 hr. lecture per week, both terms.
A continuation of subject 242.

254. Graphical Methods in Chemical Engineering. W. C. Macdonald, G. W. Minard.
Course 6, IV Year; 1 hr. laboratory per week, both terms.
This subject gives the student instruction and practice in the use of elementary principles for constructing nomograms, and the derivation of empirical equations by graphical methods.

258. Industrial Chemistry. E. A. Smith.
Course 6, IV Year; 1 hr. lecture per week, first term.
IV Year Forestry; 1 hr. lecture per week, both terms.
Pulp and paper, and cellulose industries.

259. Chemical Theory. W. C. Macdonald.
Course 6, IV Year; 1 hr. lecture per week, first term; 2 hrs. lectures per week, second term.
A course on applied chemical kinetics and Phase Rule.

DESCRIPTIVE GEOMETRY, ENGINEERING PROBLEMS AND DRAWING

DESCRIPTIVE GEOMETRY

270. Descriptive Geometry. J. R. Cockburn, A. Wardell.
All Courses, I Year; 1 hr. lecture per week, both terms.
This subject deals chiefly with the principles of orthographic and oblique projections and the application of such principles to the solutions of problems relating to straight lines and planes.

272. Descriptive Geometry. J. R. Cockburn.
Courses 1, 2, 3, 4, 5, 7, 9, 10, and 11, II Year; 1 hr. lecture per week, both term.
A continuation of the work taken in the First Year, with the following additions: problems relating to curved surfaces, principles of shades, shadows and perspective.

274. Descriptive Geometry. J. R. Cockburn.
Course 1, III Year; 1 hr. lecture per week, first term.
Spherical projections, the principles of mapmaking, and the graphical solution of spherical triangles.

ENGINEERING PROBLEMS AND DRAWING

These subjects consist primarily in the solving of problems by the student at the drafting table under the personal guidance of an instructor. The problems are intended to supplement certain lecture courses. The problems in the First and Second Years deal with the fundamental engineering studies—Mathematics, Applied Mechanics, Descriptive Geometry, the plotting of surveys that have been made by the students in the field, Theory of Mechanism, and Steam Engines, while in the Third and Fourth Years, the problems deal mainly with design. During the hours devoted to mathematical problems, members of the staff in mathematics are present to assist.

275. Engineering Problems and Drawing. A. Wardell.
Course 1, I Year; 14 hrs. per week, first term; 9 hrs. per week, second term.
Drawing and lettering. Plotting of original surveys. Problems in descriptive geometry. Graphical and analytical solutions of problems in applied mechanics. Problems in mathematics (analytical geometry and calculus).

276. Engineering Problems and Drawing. A. Wardell.
Courses 2 and 9, I Year; 6 hrs. per week, first term; 6 hrs. per week, second term.
Similar to subject 275.

277. Engineering Problems and Drawing. A. Wardell.
Courses 3 and 11, I Year; 8 hrs. per week, first term; 15 hrs. per week, second term.
Similar to subject 275.

278. Engineering Problems and Drawing. A. Wardell.
Course 4, I Year; 3 hrs. per week, both terms.
The solving of problems in descriptive geometry, applied mechanics, and mathematics in the drafting room.

279. Engineering Problems and Drawing. A. Wardell.
Courses 5 and 10, I Year; 3 hrs. per week, first term; 6 hrs. per week, second term.
Drawing and lettering. Problems in descriptive geometry. Graphical and analytical solutions of problems in applied mechanics.

280. Engineering Problems and Drawing. A. Wardell.
Course 6, I Year; 4 hrs. per week, first term; 8 hrs. per week, second term.
Elementary drawing and lettering. The solving of a few problems in descriptive geometry, applied mechanics, and mathematics.

281. Engineering Problems and Drawing. A. Wardell.
Course 7, I Year; 11 hrs. per week, first term; 6 hrs. per week, second term.
Similar to subject 275.

282. Engineering Problems and Drawing. A. Wardell.
Course 8, I Year; 8 hrs. per week, first term; 7 hrs. per week, second term.
Similar to subject 275.

283. Engineering Problems and Drawing. A. Wardell.
Course 8a, I Year; 5 hrs. per week, first term; 7 hrs. per week, second term.
Similar to subject 280.

284. Engineering Problems and Drawing.
Course 1, II Year; 8 hrs. per week, both terms.
Problems in descriptive geometry—intersection of curved surfaces. Plotting of original surveys. Problems in mechanics of materials—properties of sections, designs of simple members. Problems in mathematics (calculus).

285. Engineering Problems and Drawing.

Courses 2 and 9, II Year; 8 hrs. per week, both terms.

Problems in descriptive geometry, mechanics of materials. Flow sheet.

286. Engineering Problems and Drawing.

Course 3, II Year; 8 hrs. per week, first term; 12 hrs. per week, second term.

Course 10, II Year; 6 hrs. per week, both terms.

Course 11, II Year; 6 hrs. per week, first term; 8 hrs. per week, second term.

Problems in descriptive geometry—intersection of curved surfaces. Problems in mechanics of materials, theory of mechanism, heat engines, electricity. Problems in mathematics (calculus).

287. Engineering Problems and Drawing.

Course 6, II Year; 3 hrs. per week, first term; 6 hrs. per week, second term.

Problems in mechanics of materials, electricity, and mathematics.

288. Engineering Problems and Drawing.

Course 7, II Year; 6 hrs. per week, first term; 3 hrs. per week, second term.

Similar to subject 286, but with more problems in mathematics.

289. Engineering Problems and Drawing.

Course 8, II Year; 3 hrs. per week, first term; 3 hrs. per week, second term.

Problems in mechanics of materials, electricity, and mathematics.

290. Engineering Problems and Drawing.

Course 8a, II Year; 3 hrs. per week, first term; 6 hrs. per week, second term.

Similar to subject 287.

291. Engineering Problems and Drawing. W. B. Dunbar.

Course 1, III Year; 10 hrs. per week, first term; 9 hrs. per week, second term.

Problems in design of steel structures, riveted and welded connections, tension members, beams, columns, highway and railway trusses. Problems in descriptive geometry to illustrate the theory of map making.

292. Engineering Problems and Drawing. W. B. Dunbar.

Course 2, III Year; 3 hrs. per week, first term.

Problems in design of steel structures, riveted and welded connections, tension members, beams, columns.

293. Structural Design Drawing. W. B. Dunbar.

Course 3, III Year; 3 hrs. per week, both terms.

Similar to subject 292.

296. Engineering Problems and Drawing. W. B. Dunbar.
Course 5r III Year; 3 hrs. per week, second term.

297. Engineering Problems and Drawing. W. B. Dunbar.
Course 8a, III Year; 3 hrs. per week, both terms.

298. Structural Design Drawing. W. B. Dunbar.
Course 11, III Year; 6 hrs. per week, first term; 3 hrs. per week second term.
Similar to subject 292.

299. Engineering Problems and Drawing, Structural. W. B. Dunbar, P. V. Jermyn.
Course 1, IV Year; 6 hrs. per week, both terms.
Advanced problems on the design of steel and reinforced concrete structures—floor panels, mill buildings, tanks, reservoirs, towers, truss and arch bridges, foundations, dams, retaining walls, wind bracing. Problems on moment distribution in rigid frames, influence lines, and deflection of trusses.

300. Structural Design Drawing. W. B. Dunbar, P. V. Jermyn.
Courses 3 and 11, IV Year; 3 hrs. per week, first term.
Problems on the determination of stresses in, and the design of mill, building, flume trestles, crane runways, and floor panels for machinery loading.

BUSINESS ADMINISTRATION, ECONOMICS, HISTORY AND LAW

306. Accounting. S. G. Hennessey.
Course 11, III Year; 2 hrs. lectures and 1 hr. laboratory per week, both terms.
An introduction to the theory and practice of Accounting, the procedures followed in the preparation of financial statements, and the use of Accounting as a means of control.

307. Statistics. R. J. Sutherland.
Course 11, III Year; 2 hrs. lectures per week, both terms.
An introduction to statistical technique to include frequency distributions, correlation, curve fitting, sampling theory and an introduction to statistical quality control.

308. Applied Economics. A. B. Jack.
Course 11, III Year; 2 hrs. lectures and 1 hr. laboratory per week, both terms.
A study of modern monetary and banking theory and practice; industrial fluctuations; labour, with particular attention to problems of income distribution and labour organization.

309. Business Policy. A. W. Currie.

Course 11, IV Year; 3 hrs. lectures and 2 hrs. laboratory per week, both terms.

Financing a business enterprise with some attention to the investment program of an individual; internal administration; marketing and purchasing of industrial goods.

310. Business. R. R. Grant.

Courses 1, 2, 3, 6, 7, 8, 8a and 9, III Year; 1 hr. lecture per week, second term.

Elements of business and the basic organization thereof with an introduction to the principles of control through accounting records. The preparation of simple financial statements and explanations of the purpose of the information shown therein. A brief description of the use of business papers such as invoices, bills of exchange, and others.

311. Economics. O. W. Main.

All courses, II Year; 2 hrs. lectures per week, both terms.

An introduction to the study of Economics with special reference to the problems of the Canadian economy.

Text book: An Introduction to Political Economy—Bladen.

312. Commercial Law. D. Vanek.

Course 4, III Year; 1 hr. lecture per week, both terms.

General Principles of the Law of Contracts, Principal and Agent, Partnership and Limited Companies, with special reference to the Companies Acts. General view of the following:—Negotiable Instruments, Sale of Goods, Bills of Sale and Chattel Mortgages, Suretyship and Guarantee.

Text book: Manual of Canadian Business Law—Falconbridge and Smith.

313. Engineering Economics. C. R. Young, H. L. Shepherd.

Courses 1, 2, 3, 7, 8, 9, and 11, IV Year; 1 hr. lecture per week; second term.

Principles by which the economic practicability of a project is judged and the comparison of competing proposals is made. Consideration is given to first cost and annual cost, methods of estimating, capital charges and operating expenses, financing of engineering projects, valuation and appraisals. Special attention is given to depreciation and the methods of providing for it. Typical numerical problems are discussed and solved.

Text books: Engineering Economics—Fish. Financial Engineering—Goldman. Principles of Engineering Economy—Grant. Introduction to Engineering Economy—Woods and De Garmo.

314. Engineering Law. P. H. Mills.

Courses 1, 3, 6, 7 and 11, IV Year; 1 hr. lecture per week, first term.

Course 1c, IV Year; 1 hr. lecture per week, first term.

A subject designed to co-ordinate engineering practice and law. In the work that is common to all students taking the subject, attention is directed to the duties and liabilities of the engineer, workmen's compensation, patents and inventions, copyrights, trade marks, industrial designs, promotion of companies, organization of companies, arbitration, expert evidence, trade unions, combines, industrial disputes and professional engineering associations.

Students in the Municipal Engineering Option are given additional lectures dealing with railways, highways, boundaries and surveys, easements and drainage.

Text book: Engineering Law—Laidlaw and Young.

315. Contracts and Specifications. W. Storrie.

Courses 1 and 4, IV Year; 1 hr. lecture per week, second term.

Fundamental principles of contract and specification writing. The critical examination of typical specifications and agreements by the class, forms an essential feature of the instruction.

Text book: Engineering Law—Laidlaw and Young.

317. Plant Management. R. E. Barrett.

Course 8, IV Year; 1 hr. lecture per week, second term.

Twelve lectures dealing with some phases of labour, plant organization.

318. Industrial Management. E. A. Allcut.

Courses 1, 3, 6, 7 and 8a, IV Year; 1 hr. lecture per week, both terms.

A study of industrial organization, location, arrangement, construction, and equipment of industrial plants for efficiency and economy, process routing, scheduling work, reports, methods of superintending, employment, systems of compensating labour, and systems of distributing indirect expenses.

Text book: Principles of Industrial Management—Allcut.

319. Public Speaking. The Staff in Chemical Engineering.

Course 6, IV Year; 1 hr. lecture per week, both terms.

320. Public Speaking. G. A. McMullen.

Course 11, II Year; 1 hr. lecture per week, second term.

Course 4, III Year; 1 hr. lecture per week, both terms.

Principles of public speaking and the means of expression, accompanied by practical application and training in actual speaking.

321. Industrial Management A.

Course 11, III Year; 1 hr. lecture and 2 hrs. laboratory per week, first term; 2 hrs. lectures and 1 hr. larorator per week, second term.

An introduction to industrial organization and management, dealing particularly with its more technical aspects. Such problems as plant location, layout, arrangement, construction, handling of materials, inspection, design, and report writing are dealt with.

Text book: Principles of Industrial Management—Allcut.

322. Engineering and Society. H. L. Shepherd, G. R. Elliott.

All courses, I Year; 1 hr. lecture per week, both terms.

A series of lectures on economic history intended to show the dynamic role of science and technology in the development of the modern world, and the slow adaptation of social institutions under the impact of rapid technological change. Some attention will be given to the evolution of the more important branches of engineering and the origin of important existing practices and procedures.

323. Introduction to Political Science. R. MacG. Dawson.

All courses, III Year; 1 hr. lecture per week, both terms.

An introduction to the study of government with special reference to the problems of Canadian government.

324. Modern World History. E. W. McInnis.

All Courses, III Year; 1 hr. lecture per week, both terms.

An outline of the chief trends and developments since the beginning of the 19th Century, with emphasis on Europe, and the main aspects of international relations.

325. Modern Political and Economic Trends. L. T. Morgan.

All courses, IV Year; 1 hr. lecture per week, both terms.

A study of recent economic and political trends with particular reference to developments in the United States under the New Deal, in Italy since 1922, and in Russia since 1919.

326. Philosophy of Science. T. A. Goudge.

Courses 1, 2, 3, 5, 6, 7, 8, 8a, 9, 10, and 11, IV Year; Course 4, V Year; 18 lectures, first term, and part of second term.

Origin and development of scientific method; the range of the sciences; logical principles and the analysis of fundamental concepts; problems of life, mind and society.

327. The Profession of Engineering. C. R. Young, R. F. Legget.

Courses 1, 2, 3, 5, 6, 7, 8, 8a, 9, 10, and 11, IV Year; 6 lectures, second term.

Professional engineering organizations in Canada; engineering societies and services; professional ethics; social implications of engineering; the engineer and conservation.

328. Industrial Management B.

Course 11, IV Year; 2 hr. lecture and 3 hrs. laboratory per week, both terms.

A continuation of subject 321, dealing with such matters as production, planning, time and motion study, costs, budgetary control, and payment of labour. Particular emphasis is placed upon the study of Industrial Relations.

329. Industrial Psychology. W. Line.

Course 11, IV Year; 2 hrs. lectures per week, both terms.

The Worker as a person. His nature and needs; achievement and satisfaction; ability, motivation, interest; adjustment and development. Individual differences. Learning at the level of skills and knowledge, and in a social sense. Morale, loyalty and responsibility.

Administrative provisions. The principles applied to administrative problems, e.g. conditions of work, diagnosis of difficulties, constructive policies; supply of personnel, selection, training and supervision.

Special Services. The role of professional services, e.g. health, social welfare, psychological service etc.: their relation to the executive and to the community.

ELECTRICAL ENGINEERING

330. Electricity. H. O. Coish, H. F. Philp, A. G. Ratz, G. F. Vail, E. Wall, A. J. Kravetz.

Courses 1, 2, 3, 5, 6, 7, 8, 8a, 9, 10 and 11, I Year; 2 hrs. lectures per week, both terms.

Principles relating to electric circuits, magnetic circuits, instruments, and apparatus in general, with illustrations from commercial practice. The point of view is quantitative rather than descriptive.

Reference books: Introduction to Electrical Engineering—Mueller. Electrical Engineering—Christie.

331. Alternating Currents. E. Wall, A. G. Ratz.

Courses 1, 2, 8 and 9, II Year; 1 hr. lecture per week, both terms.

Fundamental calculations of alternating current circuits and various applications of interest to those who are not making electricity a major subject.

332. Electricity. H. O. Coish, H. A. Courtice, A. G. Ratz, E. Wall, A. J. Kravetz.

Courses 3, 5, 6, 8, 8a, and 11, II Year; 2 hrs. lectures per week, first term.

Course 7, II Year; 2 hrs. lectures per week, second term.

General principles and calculation of electrical circuits, particularly as applied to the measurement of resistance, current, potential

difference, inductance, capacity, power, and energy. The principles underlying commercial instruments are considered, together with the methods of calibration.

Reference books: Electrical Measurements—Laws. Electrical Measurements in Theory and Application—Smith. Electrical Measurements and Measuring Instruments—Golding.

333. Electrical Fundamentals. E. Wall, H. F. Philp.

Course 7, II Year; 2 hrs. lectures per week, both terms.

A series of lectures extending the study of the fundamental principles underlying the work of subject 332. Applications considered are of particular interest to electrical engineers.

334. Electrical Measurements Laboratory. H. A. Courtice.

Courses 3, 5, 6, 8, 8a, and 11, II Year; 3 hrs. laboratory per week, first term.

Course 7, II Year; 6 hrs. laboratory per week, second term.

The more important methods of measurement of resistance, current, potential difference, inductance, and capacity are used, often under conditions such as occur in practice. The principles of measurement are applied to other problems such as the location of line faults and the measurement of temperature rise by resistance changes. Methods of calibrating commercial instruments are also included.

336. Mathematical Applications in Electrical Engineering. V. G. Smith, L. S. Lauchland, D. N. Cass-Beggs.

Course 7, III Year; 3 hrs. lectures per week, second term.

These lectures are intended to co-ordinate certain branches of mathematics, such as complex numbers, simple determinants, and elementary differential equations, with their applications to the problems of electrical engineering.

337. Electronics. J. E. Reid, G. Sinclair.

Courses 5c, 5i, 5s, and 7, III Year; Course 5r, IV Year; 3 hrs. lectures per week, second term.

The behaviour of electrons in electric and magnetic fields and the applications of electronics to electrical engineering.

Reference book: Applied Electronics—M.I.T. Staff.

338. Direct Current Machines. A. G. Ratz, G. F. Vail, A. J. Kravetz, H. O. Coish.

Courses 3 and 11, II Year; Course 10, III Year; 2 hrs. lectures per week, second term.

Courses 3 and 11, II Year; 3 hrs. laboratory per week, second term.

A course on the theory and operation of direct current generators and motors.

Reference books: Electrical Engineering, IVol. —Dawes. Electrical Circuits and Machinery, Vol. I—Morecroft and Hehre. Elements of Electrical Engineering—Cook.

339. Direct Current Machines. G. F. Tracy, D. N. Cass-Beggs.

Courses 5 and 7, III Year; 2 hrs. lectures per week, first term.

The theory and operation of direct current machines. Methods of calculating the operating characteristics of generators and motors are presented and illustrated by the use of problems.

Reference books: Electrical Engineering, Vol. I—Dawes. Electrical Circuits and Machinery, Vol. I—Morecroft and Hehre. Principles of D.C. Machines—Langsdorf. Direct Current Machinery—Pender. Electrical Engineering—Christie. Elements of Electrical Engineering—Cook. D.C. Machinery—Kloeffler, Brenneman and Kerchner. Direct Current Machinery—McFarland. Direct Current Machinery—Bull.

340. Alternating Currents. A. R. Zimmer.

Courses 3, 5r, 10, and 11, III Year; 2 hrs. lectures per week first term.

Courses 6 and 8a, III Year; 2 hrs. lectures per week, first term.

Measurements in simple single-phase and polyphase circuits. Circuit problems are solved by analytical and graphical methods. The operation of induction and synchronous motors and transformers is discussed briefly.

Reference books: Electrical Engineering, Vol. II—Dawes. Electrical Circuits and Machinery, Vol. II—Morecroft and Hehre. Elements of Electrical Engineering—Cook.

341. Alternating Currents. A. R. Zimmer, J. E. Reid.

Courses 5c, 5g, 5i, 5s, and 7, III Year; 2 hrs. lectures per week, both terms.

A first course of lectures on alternating current, covering principles of measurement and leading to the analytical and graphical treatment of the simpler problems relative to alternating-current circuits and machinery.

Reference books: Electricity and Magnetism for Engineers, Part II—Pender. Electrical Engineering—Christie. Electrical Engineering, Vol. II—Dawes. Electrical Circuits and Machinery, Vol. II—Morecroft and Hehre. Alternating Current Circuits—Kerchner and Corcoran. Alternating Current Circuits—Bryant, Correll and Johnson. Alternating Current Electrical Engineering—Maccall. Alternating Current Electrical Engineering—Kemp. Elements of Electrical Engineering—Cook.

342. Electrical Design. L. S. Lauchland.

Courses 5c, 5i, 5s and 7, III Year; 2 hrs. lectures per week, first term.

Course 7, III Year; 6 hrs. laboratory per week, first term.

Derivation and application of formulae used in the design of magnets, direct current machines, transformers, and other electrical equipment.

343. Electrical Problems and Seminar.

Course 7, III Year; 2 hrs. per week, both terms.

344. Electrical Laboratory. A. R. Zimmer.

Courses 5c, 5g, 5i and 5s, III Year; 3 hrs. laboratory per week, both terms.

Course 7, III Year, 6 hrs. laboratory per week, first term; 3 hrs. laboratory per week, second term.

A group of experiments on direct current machines, another group on the fundamentals of alternating current circuits, together with experiments on properties of magnetic materials, and on the fundamentals of electronic devices. Introductory experience in the use of alternating current machinery is afforded.

345. Alternating Current Machinery. D. E. McGregor.

Courses 3, III Year; Course 11, IV Year; 2 hrs. lectures per week, second term.

Characteristics of alternating current machines and the various methods of control

346. Electrical Laboratory. A. R. Zimmer.

Course 3, III Year; 3 hrs. laboratory per week, both terms.

Course 11, III Year; 3 hrs. laboratory per week, first term.

Course 11, IV Year; 3 hrs. laboratory per week, second term.

Experiments on alternating current circuits and machines.

347. Electrical Laboratory. A. R. Zimmer.

Course 5r, III Year; 3 hrs. laboratory per week, both terms.

A modified subject based on subject 344.

348. Electrical Machinery. D. E. McGregor.

Courses 2 and 8, III Year; 2 hrs. lectures per week, first term.

Lectures and demonstrations dealing with the operation and characteristics of electrical machinery.

349. Electrical Laboratory. A. R. Zimmer.

Courses 6 and 8a, III Year; 3 hrs. laboratory per week, first term.

Experiments on direct current generators and motors, and alternating current circuits and machines.

350. Electrical Laboratory. A. R. Zimmer.

Courses 1, 2, 8 and 9, II Year; 3 hrs. laboratory per week, second term.

Experiments planned to give a general knowledge of the operation of direct current machines, simple alternating current circuits, and alternating current machines.

351. Circuit Analysis. V. G. Smith.

Courses 5c and 7, IV Year; 2 hrs. lectures per week, first term; 3 hrs. lectures per week, second term.

Applications of advanced analytical methods made to a.c. bridges, electrical filters, and other networks. Several general network theorems are obtained. The method of symmetrical components is developed and used to solve problems involving unbalance in three-phase circuits. Complex wave forms of voltage and current and their analysis are considered in detail. Simple transients in a.c. circuits are also studied.

Reference books: Principles of Alternating Currents—Lawrence. Alternating Current Circuits—Weinbach. Alternating Current Bridge Methods—Hague. Symmetrical Components—Wagner and Evans. Alternating Current Circuits—Kerchner and Corcoran.

352. Transmission at Low and High Frequencies. J. E. Reid.

Courses 5c and 7, IV Year; 2 hrs. lectures per week, both terms.

The behaviour of a long line when the voltages and currents are sinusoidal is examined in detail. Graphical constructions are developed and applied to both short and long lines. Circuits with lumped and distributed constant are analyzed over wide ranges of frequency and impedance. The distributed inductance and capacity of a three-phase transmission line are found.

353. Alternating Current Machinery I. D. N. Cass-Beggs, G. F. Tracy.

Courses 5r and 7, IV Year; 3 hrs. lectures per week, first term, 1 hr. lecture per week, second term.

The theory and performance of transformers, generators, synchronous motors, single and polyphase induction motors.

Reference books: Theory of Alternating Current Machinery—Langsdorf. Principles of Alternating Current Machinery—Lawrence. Alternating Current Machines—Puchstein and Lloyd. Alternating Current Machinery—Bryant and Johnson. Electrical Engineering—Christie.

355. Electrical Laboratory. D. N. Cass-Beggs.

Course 7, IV Year; 4½ hrs. laboratory per week, first term; 1½ hrs. laboratory per week second term.

Studies of principles and properties of single-phase and polyphase circuits and apparatus. Vector and analytical methods are applied to the solution of problems related to the characteristics of transformers, alternators, synchronous motors, converters, induction motors, transmission lines, and other alternating current equipment. The principles and properties of electronic equipment used in low frequency and power fields, such as mercury arc rectifiers and thyratrons, are studied.

Reference books: Electrical Engineering—Christie. Experimental Electrical Engineering, Vols. I and II—Karapetoff. Principles of A.C. Machinery—Lawrence. A.C. Machinery—Bryant and Johnson. Principles of Alternating Current Machinery—Langsdorf

356. Electrical Laboratory. A. R. Zimmer, D. N. Cass-Beggs.

Course 5c, IV Year; 4½ hrs. laboratory per week, both terms.

A modified course based on subject 355.

357. Engineering Electronics. D. N. Cass-Beggs.

Course 7, IV Year; 2 hrs. lecture per week, first term; 1 hr. lectures per week, second term.

Electronic devices, such as the thyratron, ignitron and mercury arc rectifier, and their application to engineering problems.

Reference books: Electron Tubes in Industry—Henney. Fundamental Electronics and Vacuum Tubes—Albert. Fundamentals of Engineering Electronics—Dow. Applied Electronics—E. E. Staff, M.I.T.

358. Engineering Electronics Laboratory. D. N. Cass-Beggs.

Course 7, IV Year; 3 hrs. laboratory alternate weeks, both terms.

Laboratory experiments to accompany subject 357.

359. Electrical Problems and Seminar.

Course 7, IV Year; 2 hrs. per week, both terms.

360. Communications I. J. E. Reid, G. Sinclair.

Courses 5c, 5i, 5s and 7, IV Year; 3 hrs. lectures per week, first term.

The basic principles of amplification, detection, modulation, demodulation, and radio-frequency power generation.

Reference books: Applied Electronics—M.I.T. Staff.

361. Communications Laboratory. G. Sinclair.

Courses 5c, 5i, 5s, and 7, IV Year; 3 hrs. laboratory per week, first term.

Experiments and problems to accompany subject 360.

362. Communications II. J. E. Reid, G. Sinclair.
Courses 5c and 7, IV Year; 3 hrs. lectures per week, second term.
A continuation of subject 360.

363. Communications Laboratory. G. Sinclair.
Courses 5c and 7, IV Year; 3 hrs. laboratory per week, second term.
Experiments and problems to accompany subject 362.

364. Operational Methods. V. G. Smith.
Courses 5c, 5i and 5s, IV Year; 2 hrs. lectures per week, both terms.
A few examples of earlier operational methods are given. The operators of electric circuits are developed and solutions obtained, in the course of which several useful rules concerning shifting and transfer operations, and differentiation and integration with respect to parameters are found and applied. The Heaviside expansion theorem is developed in a simple manner. The connection between Heaviside's methods and the classical methods of Fourier Integrals and Contour Integration is investigated in some detail. Application is made throughout to engineering problems, chiefly in the field of electric circuit analysis.

Reference books: Electromagnetic Theory—Heaviside. Operational Circuit Analysis—Bush. Electric Circuit Theory and the Operational Calculus—Carson. Heaviside's Operational Calculus—Berg. Fourier Integrals for Practical Applications—Campbell and Foster.

365. Applied Electromagnetic Theory. V. G. Smith.
Courses 5c, 5g and 5s, IV Year; 2 hrs. lectures per week, both terms.
The laws of electromagnetism are reviewed and Maxwell's field equations developed. Plane electromagnetic waves and their reflection and refraction at plane surfaces are studied. Skin effects in cylindrical conductors, both solid and hollow are considered. Transmission of energy by wave guides and co-axial cables is investigated. The laws and formulae of the radiation of energy from vertical antennae are developed. The capacity of cables and transmission lines is computed and comparison made between the exact and approximate formulae. Magnetic fields due to conductors carrying current in the neighbourhood of ferromagnetic bodies are investigated in some of the more simple cases.

Reference books: Electromagnetic Theory—Heaviside. Electromagnetic Theory—Stratton. Electromagnetic Problems in Electrical Engineering—Hague.

366. Aircraft Electricity. J. E. Reid.
Course 10, IV Year; 1 hr. lecture per week, second term.
Types of electrical equipment used in aircraft and airports, and with the principles of aircraft radio equipment such as the radio range, radio compass, radio altimeter, direction finding, etc.

367. A. C. Machinery Laboratory. D. N. Cass-Beggs.
Course 5r, IV Year; 3 hrs. laboratory per week, first term.
A short laboratory course in alternating current electrical machinery.

368. Electronics Laboratory. D. N. Cass-Beggs.
Course 5r, IV Year; 3 hrs. laboratory per week, second term.
A short laboratory course in electronics, vacuum tubes, and engineering electronics.

369. Alternating Current Machinery II. G. F. Tracy, D. N. Cass-Beggs.
Course 7, IV Year; 2 hrs. lectures per week, second term.
A continuation of subject 353. Special types of alternating current motors, synchronous converters, single-phase induction motors.

370. Alternating Current Machinery Laboratory. G. F. Tracy, D. N. Cass-Beggs.
Course 7, IV Year; 3 hrs. laboratory alternate weeks, second term.
Laboratory exercises to accompany subject 369.

371. Ultra-High Frequency Communications. G. Sinclair.
Courses 5c and 7, IV Year; 2 hrs. lectures per week, second term.
Generation of microwaves. Magnetrons, velocity-variation tubes, resonatrons, etc. Wideband amplifiers and amplification of pulses. High-frequency measurements.

372. Ultra-High Frequency Laboratory. G. Sinclair.
Courses 5c and 7, IV Year; 3 hrs. laboratory alternate weeks, second term.
Laboratory exercises and problems to accompany subject 371.

GEOLOGICAL SCIENCES

GEOLOGY

380. Geological Field Work. G. B. Langford, W. W. Moorhouse.
Courses 2 and 9, III Year; one week at the University Survey Camp preceding the opening of the first term.

381. Geology, Pleistocene and Physiographic. A. MacLean.
Courses 2 and 9, IV Year; 1 hr. lecture per week, both terms.
Pleistocene Geology. The formation and distribution of the

drift deposits of North America, with brief references to other regions.

Physiography. The surface forms of the earth, and the geological factors that have produced them.

Reference books: Ice Ages, Recent and Ancient, and The Last Million Years—Coleman. Physiography—Salisbury.

382. Geological Excursions. A. MacLean.

Courses 2 and 9, IV Year.

During October weekly trips will be made to points of interest near Toronto.

383. Historical Geology. L. S. Russell.

Course 9, III Year; 2 hrs. lectures per week, both terms.

Principles of sedimentation, divisions of the geological column, and the use of fossils in correlation of formations.

Textbook: Historical Geology—Schuchert and Dunbar.

384. Historical Geology Laboratory. L. S. Russell.

Course 9, III Year; 2 hrs. laboratory per week, both terms.

Study of fossils, sediments, and geological maps and sections. A laboratory course to accompany subject 383.

385. Engineering Geology. A. MacLean.

Courses 1 and 5g, III Year; 1 hr. lecture per week, first term; 2 hrs. lectures per week, second term.

Structural, dynamic and economic geology, with special reference to engineering problems.

Reference books: Engineering Geology—Ries and Watson. Geology and Engineering—Legget.

386. Engineering Geology Laboratory. G. B. Langford.

Courses 1 and 5g, III Year; 2 hrs. laboratory per week, second term.

Specimens, maps, and sections to accompany subject 385.

388. General Geology. F. G. Smith.

Courses 2 and 9, II Year; 2 hrs. lectures per week, first term; 1 hr. lecture per week, second term.

Geological principles, designed to introduce the student to the study of geology.

Reference books: Geology—Emmons, Thiel, Stauffer, and Allison. Elementary Geology for Canada—Moore.

389. General Geology. F. G. Smith.

Courses 2 and 9, II Year; 2 hrs. laboratory per week, second term.

Maps and sections; accompanying subject 388.

390. Structural Geology. G. B. Langford.
Courses 2 and 9, III Year; Course 5g, IV Year; 2 hrs. lectures per week, first term.
Structures caused by the deformation of the earth's crust.
Text books: Geologic Structures—Willis. Structural Geology—Nevin.

391. Structural Geology. G. B. Langford.
Courses 2 and 9, III Year; Course 5g, IV Year: 3 hrs. laboratory per week, both terms.
Work with geological maps of folded and faulted areas, structure sections, and the solution of problems relating to folding and faulting. Laboratory course to accompany subject 390.

392. Precambrian Geology. E. S. Moore.
Courses 2 and 9, IV Year; 2 hrs. lectures per week, first term.
Precambrian formations of Canada—their rocks, distribution, relationships, and economic features. Briefer accounts are given of similar formations in the United States and elsewhere.
Reference books: Publications of the Dominion and Provincial geological surveys. Mineral Deposits of the Canadian Shield—Bruce.

393. Mining Geology. G. B. Langford.
Course 9, IV Year; 2 hrs. lectures per week, first term; 1 hr. lecture per week, second term.
Detailed study of the geology of Canadian and foreign mining camps.

394. Mining Geology. G. B. Langford.
Course 9, IV Year; 3 hrs. laboratory per week, both terms.
A laboratory course to accompany subject 393.

396. Mining Geology. E. S. Moore.
Course 2, IV Year; 2 hrs. lectures per week, second term.
Geological problems associated with mining, typical mining regions in Canada, the United States, and elsewhere discussed from the geological side.
Reference books: Gold Fields of the World—Emmons. Economic Mineral Deposits—Bateman.

397. Precambrian and Economic Geology Laboratory. W. W. Moorhouse.
Course 9, III Year; 2 hrs. laboratory per week, second term.
Special attention to Precambrian formations and the microscopic features of the rocks and mineral deposits.

398. Economic Geology. E. S. Moore.
Course 9, III Year; Course 5g, IV Year.
(*a*) Ore Deposits: 1 hr. lecture per week, both terms.

Discussion of the origin and classification of ore deposits, the mode of occurrence of the chief ores, and statistics of production. Special attention is given to the metals mined in Canada.

(*b*) Economic Geology of the non-metals: 2 hrs. lectures per week, second term.

The origin and mode of occurrence of the valuable non-metallic substances—coal, oil, building stone, gypsum, cement materials, etc.

Reference books: Economic Geology — Ries. Coal — Moore. Geology of Petroleum and Natural Gas—Lilley. Mineral Resources of Canada—Moore. Introduction to the Study of Ore Deposits—Hatch.

399. Economic Geology. E. S. Moore, F. G. Smith.

Course 2, III Year.

(*a*) Ore Deposits: 1 hr. lecture per week, both terms.

(*b*) Economic Geology of the non-metals: 1 hr. lecture per week, second term.

Similar to subject 398.

400. Economic Geology Laboratory. G. B. Langford.

Course 9, III Year; Course 5g, IV Year; 3 hrs. laboratory per week, both terms.

Ores, geological features of mining areas, interpretation of drill logs, geological maps, and structure sections. Excursions are included.

401. Location of Mineral Deposits. G. B. Langford.

Course 5g, IV Year; 1 hr. lecture per week, second term.

Geological features and principles involved in the application of geophysical methods in the search for mineral deposits, and the interpretation of the structure of the earth's crust.

402. Economic Geology. G. B. Langford.

Course 8a, IV Year; 2 hrs. lectures per week, second term.

The nature, occurrence, and origin of non-metallic deposits, excepting fuels.

Reference book: Industrial Minerals and Rocks—A.I.M.E.

403. Geology of Canada. A. MacLean.

Course 9, IV Year; 2 hrs. lectures per week, first term; 1 hr. lecture per week, second term.

A survey of the physiography, historical geology, major structural features, and mineral deposits of the country.

404. Geology of Canada. A. MacLean.

Course 9, IV Year; 2 hrs. laboratory per week, second term.

Accompanying subject 403.

405. Building Materials; Stone. G. B. Langford.

Course 4, IV Year; 1 hr. per week, first term.

Lectures and laboratory work on decorative and structural

stones used in building; their properties, sources, extraction, and preparation for use in buildings.

Reference book: Building Stones and Clay Products—Ries.

HEAT ENGINES

420. Elementary Heat Engines. The Staff in Mechanical Engineering.

Courses 3 and 11, II Year; 1 hr. lecture per week, both terms.

Courses 2, 7, 8, 9 and 10, II Year; 1 hr. lecture per week, first term.

The history and development of heat engines generally, the principles upon which they operate, and brief descriptions of the mechanical and thermal features of the different kinds of heat engines used in practice.

Text book: An Introduction to Heat Engines—Allcut.

421. Theory of Heat Engines. The Staff in Mechanical Engineering.

Courses 3, 5r, 6, 7, 8a, 10, and 11, III Year; 2 hrs. lectures per week, both terms.

The application of the laws of thermodynamics, indicating the best conditions for heat engine operation and the maximum possible efficiency, as exemplified by the Carnot and regenerative cycles. The properties of working fluids are studied, and the effect of departures from the perfect cycle is illustrated by the Joule, Otto, Diesel, and Rankine cycles. The uses of entropy diagrams and refrigeration cycles are also considered.

422. Heat Engineering. R. C. Wiren.

Course 3, III Year; 1 hr. lecture per week, both terms.

Internal combustion engines. Types and operation; performance and testing; basic characteristics and principles of design; carburetion; fuel injection; governing.

Steam Turbines. Types and basic characteristics; condensers; cooling towers.

Reference books: Elementary Heat Power—Solberg, Cromer and Spalding. Internal Combustion Engines—Polson, Maleev, Jennings and Obert. Steam Turbines—Church.

Course 3, III Year; 1 hr. lecture per week, first term.

Steam generators and plant. Combustion calculations; analysis of fuels and products of combustion; boiler tests and heat balance; principles of design and commercial types of boilers, furnaces, stokers, pulverized fuel equipment, economizers, air heaters, superheaters, etc.

Text book: Heat Engines—Allen and Bursley.

Reference books: Elementary Heat Power—Solberg, Cromer and Spalding. Steam Power Stations—Gaffert.

Course 3, III Year; 1 hr. lecture per week, second term.

Air conditioning. Air and water vapour mixtures; requirements for comfort and industrial processes; the use of psychrometric charts; heat transmission calculations; heating, cooling, humidifying, and dehumidifying processes; calculation of air conditioning loads; air conditioning systems and equipment.

Text book: Air Conditioning—Holmes.

Reference books: Heating and Air Conditioning—Allen, Walker and James. Air Conditioning Principles—Mackey.

423. Heat Engine Laboratory. R. C. Wiren, W. T. Thompson.

Courses 3, 5r, and 10, III Year; 1 three-hr. laboratory period per week, both terms.

Course 7, III Year; 1 three-hr. laboratory period per week, first, term.

Course 11, III Year; 1 three-hr. laboratory period per week, second term.

Mechanical Experiments. I. W. Smith.

Included in above.

Heat Transfer Experiments. F. G. Ewens.

Included in above.

A laboratory subject designed to assist in a clearer understanding of thermodynamics, machine design, and mechanics of machinery. The work on heat engines includes the setting of slide valves, measuring indicated and brake horse-power, and testing of air compressors, blowers, steam engines and internal combustion engines under various conditions, analysis of fuels and products of combustion, fuel calorimetry, steam calorimetry, etc.

The mechanical laboratory work deals with testing of belts, governors and lubricating oils, and experiments on balancing of rotating masses. The heat transfer laboratory work deals with testing of insulation, heat exchangers and air conditioning equipment.

424. Heat Power Engineering. R. C. Wiren.

Courses 3 and 5r, IV Year; 2 hrs. lectures per week, first term; 1 hr. lecture per week, second term.

A continuation of lecture course 421. Properties of working substances; transitional stages from liquid to vapour to gas; calculations involving variable specific heats; insulation and heat transfer; refrigeration; power plant cycles including reciprocating engines and turbines; cycles for high pressures and temperatures; superheating, reheating, regenerative, and binary-fluid cycles; steam generators employing forced circulation, indirect evaporation and pressure combustion; power plant heat balance and efficiencies; steam turbines.

425. Internal Combustion and Aircraft Engines. E. A. Allcut.

Courses 3, 5r and 10, IV Year; 1 hr. lecture per week, both terms.

The difference between the efficiencies theoretically attainable and those actually achieved in internal combustion engines is examined in detail. The properties of the fuels used in gasoline and Diesel engines, the methods of testing them, and the various heat losses are described. Some consideration is also given to supercharging, detonation, cooling, and similar practical problems.

426. Heat Engine Laboratory. R. C. Wiren, B. D. Wood.

Courses 3 and 5r, IV Year; average 5½ hrs. laboratory work per week, both terms.

Heat Transfer Experiments. F. G. Ewens.

Included in above.

Mechanical Experiments. I. W. Smith.

Included in above.

A continuation and extension of the work covered in the III Year laboratory subject. Complete tests are made of heaters and of engines of various types such as simple, compound and uniflow steam engines, steam turbines, refrigerating machines, injectors, gas, oil and gasoline engines, air conditioning equipment, etc. and an analysis is made of the thermal cycles involved. A complete set of experiments is made in each case and the results plotted to show clearly to the student the effect of various alterations in adjustment on the results obtained. A complete boiler test is performed and all calculations are made for a heat balance. Experiments are performed on balancing of rotating masses.

427. Theory of Heat Engines. R. C. Wiren.

Courses 1 and 8, III Year; Course 2, IV Year ; 1 hr. lecture per week, both terms.

Thermodynamics of gases and vapours as applied to heat engine cycles and exemplified by internal combustion engines, air compressors, steam engines and turbines, and refrigerating plants.

Reference books: Elementary Engineering Thermodynamics—Young and Young. Engineering Thermodynamics—Ebaugh.

428. Heat Engine Laboratory. R. C. Wiren, W. T. Thompson.

Course 1, III Year; eight 3-hr. laboratory periods, second term.

Course 6, III Year; average 1½ hrs. laboratory per week, second term.

Course 8, III Year; 1½ hrs. laboratory per week, second term.

Course 8a, III Year; 1½ hrs. laboratory per week, second term.

Course 2, IV Year; 1½ hrs. laboratory per week, first term.

Experiments with steam and internal combustion engines, compressed air, etc.

429. Heat Transfer and Refrigeration. F. G. Ewens.

Course 5r, IV Year; 2 hrs. lectures per week, both terms.

Refrigeration cycles and properties of refrigerants; flow of fluids and heat transfer; heat insulation; refrigerating machines and controls; air conditioning; cold storage; ice manufacture: industrial applications of refrigeration.

Reference books: Theory of Mechanical Refrigeration—Sparks. Refrigeration Engineering—Macintire. Applied Heat Transmission—Stoever. Heating and Air Conditioning—Allen, Walker and James.

HYDRAULICS AND FLUID MECHANICS

440. Hydraulics. G. R. Lord, L. E. Jones, D. G. Huber, W. J. Laari, H. M. MacFarlane.

Courses 1, 3, 6, 7, and 11, III Year; 2 hrs. lectures per week, both terms.

Course 2, III Year; Course 8a, IV Year; 2 hrs. lectures per week, first term.

Attention is given to the development and discussion of the fundamental principles of fluid flow. These principles are illustrated by suitable practical problems connected with fluid measurements, flow of water and other fluids in pipes, open channel computations; with a brief discussion of the resistance of submerged bodies, dimensional analysis and similarity studies.

Text book: Elementary Fluid Mechanics—Vennard.

441. Hydraulic Laboratory. G. R. Lord, L. E. Jones, D. G. Huber.

Courses 1, 3, 7, and 11, III Year; one 3 hr. laboratory period per week, second term.

Courses 2 and 6, III Year; six 3 hr. laboratory periods, first term.

Course 8a, IV Year; one 3 hr. laboratory period per week, first term.

This laboratory course is planned to illustrate the principles considered in the lecture courses in hydraulics. Experimental work in the laboratory utilizes a wide variety of apparatus and equipment concerned with fluid flow, while problems undertaken in the study room provide a link with general hydraulic practice.

442. Hydraulics. G. R. Lord.

Course 3, IV Year; 1 hr. lecture per week, both terms.

The various problems of unsteady flow such as occur in power plants, penstocks, etc. Much of the work is done by the process of arithmetic integration, and the lecture work is supplemented by problems solved by the students in the work rooms, the time for which is included in subject 444. Surges, water hammer, stream flow data, etc., are discussed.

The problems of collection of water for power purposes, use of the mass curve, rainfall and evaporation, etc., are also treated as far as possible. The flow of gases and vapours is also discussed.

443. Hydraulics. G. R. Lord.

Course 3, IV Year; 1 hr. lecture per week, first term; 2 hrs. lectures per week, second term.

Theory and design of turbines, pumps, fans, propellers, and other hydraulic machinery, as well as the application of hydraulic systems to aircraft and machine tools. The selection of turbines, pumps, and fans is dealt with, as well as problems related to the mechanical parts of hydraulic power plants. Cavitation in connection with pumps, turbines, and propellers is fully discussed.

444. Hydraulic Laboratory. G. R. Lord, L. E. Jones, D. G. Huber.

Course 3, IV Year; average of 5½ hrs. laboratory per week in 3 and 2 hr. periods, both terms.

Experimental work is carried out in the laboratory on various types of pumps, turbines, fans, centrifugal compressors and on hydraulic models. In addition computation problems involving open channel flow, water power studies, pumps and turbine studies, water hammer phenomena and other advanced flow problems are considered. General problems involving compressibility of gases are considered.

445. Hydraulics. G. R. Lord.

Course 1, IV Year; 2 hrs. lectures per week, both terms.

General hydraulic problems such as surges in pipe lines, water hammer, flow in open channels and backwater, mass curves and a general discussion of pumps.

446. Hydraulic Laboratory. G. R. Lord, L. E. Jones, D. G. Huber.

Course 1, IV Year; one 3 hr. laboratory period per week, both terms.

Experimental studies of hydraulic models, turbines and pumps are carried out. Problems assigned in the study rooms deal with channel flow and other hydraulic features connected with water power installations, flood control, water supply and drainage systems.

447. Elementary Hydraulics. The Staff in Mechanical Engineering.

Courses 1, 3, 6, 7, 8, 8a and 11, II Year; 1 hr. lecture per week, first term.

Fluid properties. Theorems of fluid statics. Pressure-density-height relationships. Measurement of pressure intensity. Fluid

thrust on submerged surfaces. Buoyancy and flotation.

Text book: Elementary Fluid Mechanics—Vennard.

448. Mechanical and Thermal Measurements. The Staff in Mechanical Engineering.

Courses 2, 3, 6, 7, 8, 8a, 9 and 11, I Year; 1 hr. lecture per week, both terms.

An introduction to common engineering quantities, and means of measuring them. Dimensions, units, standards, length, area, angle, etc. Time, speed, acceleration, etc. Mass, pressure, specific gravity, power, etc. Temperature, heat quantity, expansivity, etc.

449. Treatment of Technical Data. L. E. Jones, W. J. Laari, J. E. K. Foreman.

Course 3, II Year; 2 hrs. lectures per week, second term.

Presentation of data; approximate nature of technical data; role played by mathematics; general numerical methods; methods of organizing data for computation; methods of analysing technical data; elements of curve-fitting and statistical treatment.

451. Hydraulics. G. R. Lord.

Course 2, IV Year; 1 hr. lecture per week, second term.

Pumping and drainage problems connected with the operation of mines and mining properties.

452. Aircraft Hydraulics. G. R. Lord.

Course 10, IV Year; 1 hr. lecture per week, first term.

A discussion of the numerous aircraft services that require remotely controlled power operation which can best be performed hydraulically. The basic principles underlying the design of aircraft hydraulic systems are considered in order that the student may understand present systems and master sufficient of the fundamental theory to enable him to follow future design.

Text book: Aircraft Hydraulics—Adams.

MACHINERY

461. Mechanical Engineering. The Staff in Mechanical Engineering.

Course 3, II Year; 2 hrs. lectures per week, first term.

Materials of design and production methods. In addition, standards, tolerances, limits, fits, and mechanical drafting room practice will be explained.

Text books: Drawings and Drafting Room Practice. A.S.A. Manufacturing Processes—Begeman.

462. Elementary Machine Design. The Staff in Mechanical Engineering.

Courses 6, 7, 8 and 8a, II Year; 2 hrs. lectures per week, second term.

A preparatory subject intended to familiarize the student with the different shop methods and processes, casting, forging, machin-

ing, etc., used in the production of machine parts, to enable him to make proper provision in the design of such parts to facilitate their production.

In addition, the various standards, machine and pipe threads, tapers, pipe fittings, etc., are described and mechanical drafting room practice explained. Tolerances, limits, fits and gauges are discussed.

Text book: Factory Equipment—Roe and Lytle. Drawings and Drafting Room Practice. A.S.A.

463. Machinery. R. T. Waines.

Course 1, III Year; 2 hrs. lectures per week, first term.

Design and selection of various machine elements, with particular reference to their application to bridges, shovels and other machinery affecting civil engineers.

Text book: Design of Machine Elements—Faires.

464. Machine Design Laboratory. W. G. McIntosh, I. W. Smith, R. T. Waines.

Course 1, III Year; 3 hrs. laboratory per week, first term.

The work in the laboratory and the drafting problems assigned will illustrate the lecture subject.

465. Theory of Machines A. The Staff in Mechanical Engineering.

Courses 3 and 10, II Year; 2 hrs. lectures per week, both terms.

A study of basic machine components, including the standard linkages, cams, gearing, and gear trains, with reference to practical applications. Methods for analysis of velocity, acceleration, and force distribution in machines. Effects of friction and determination of efficiency. The plotting and use of crank effort and torque diagrams.

Text book: Mechanism—Prageman.

466. Theory of Machines B. I. W. Smith.

Course 3, III Year; 2 hrs. lectures per week, first term.

A consideration of inertia forces and their effect in machines. Fluctuation of machine speed and its control by flywheels and governors. Balancing of rotating parts, engine balance, elementary vibration.

A working knowledge of velocity, acceleration, and force analysis is essential in this course.

Reference books: Theory of Machines—Angus. Mechanics of Machinery—Ham and Crane. Internal Combustion Engines—Degler. Vibration Analysis—Myklestad.

467. Machine Design. W. G. McIntosh.

Courses 3, 10, and 11, III Year; 2 hrs. lectures per week, both terms.

The design of various machine elements, including screw threads for fastening and power transmission, shafting, bearings (journal, thrust, ball, and roller) belts, pulleys, spur gears, flywheels, keys, clutches, etc.

Text book: Design of Machine Elements—Faires.

468. Machine Design and Mechanics of Machinery Laboratory. W. G. McIntosh, I. W. Smith, R. T. Waines.

Course 3, III Year; an average of 7½ hrs. laboratory per week, both terms.

Course 7, III Year; 3 hrs. laboratory per week, second term.

Course 10, III Year; 6 hrs. laboratory per week, both terms.

Course 11, III Year; 3 hrs. laboratory per week, both terms.

The work in the laboratory will consist of analytical and graphical solution of problems illustrating the principles involved in the lecture course in Mechanics of Machinery, and the design of machine parts covered in the lecture course in Machine Design. The object of the work on the drafting board is with a view to developing the students' judgment and sense of proportions in design and the application of drafting room standards.

469. Machine Design. R. T. Waines.

Courses 2, 6, 8 and 8a, IV Year; 1 hr. lecture per week, both terms.

The design of various machine elements, particularly those likely to be met with in chemical and metallurgical plants, and in mining work.

Text book: Design of Machine Elements—Faires.

470. Machine Design Laboratory. W. G. McIntosh, I. W. Smith, R. T. Waines.

Courses 2, 6, 8 and 8a, IV Year; 3 hrs. laboratory per week, second term.

Problems worked out in the laboratory, designed to give the student training in the general lay-out of shafting and plant machinery, as well as in the design of simple parts for chemical and metallurgical apparatus, and mine machinery.

471. Machine Design. S. Rodwin.

Course 5, III Year; 1 hr. lecture per week, both terms.

(This course will not be given in 1948-49.)

Some acquaintance with the selection of materials and their use in the design and construction of machinery. Machine parts are analysed as to suitable materials, production methods, and the nature and magnitude of the stresses encountered.

Text book: Design of Machine Elements—Faires.

472. Machine Design Laboratory. W. G. McIntosh, I. W. Smith, R. T. Waines, S. Rodwin.

Course 5, III Year; 3 hrs. laboratory per week, both terms.

(This course will not be given in 1948-49.)

The work in the laboratory will consist of the analytical solution of problems, illustrating the principles involved in the lecture course, and the standard practice in making assembly and detail machine drawings.

473. Machine Design. W. G. McIntosh.

Course 3, IV Year; 2 hrs. lectures per week, both terms.

Design of machine frames, hooks, hoisting equipment, crank shafts, gears of various kinds (helical, herringbone, bevel, screw, worm), springs, clutches, brakes, thin and thick wall vessels. An introduction will be given to the study of dynamic problems connected with the motor car, Diesel engine, and other high speed machinery.

Text book: Design of Machine Elements—Faires.

474. Advanced Machine Design Laboratory. W. G. McIntosh, I. W. Smith, R. T. Waines.

Course 3, IV Year; 5 hrs. laboratory per week, first term; 6 hrs. laboratory per week, second term.

Work in the laboratory devoted to the design of complete machines, with the object of giving the student practice not only in the design of various details, but also in working the various elements into a machine of smooth and harmonious design. The machines chosen as examples for design involve as many new machine elements as possible, in order to broaden the training of the student.

The work in the laboratory also involves special shafting problems, including graphical solutions, critical speeds, and multiple supports.

475. Machine Design. I. W. Smith.

Course 7, III Year; 2 hrs. lectures per week, both terms.

Principles of stress analysis and the design of various machine elements, including screw threads, shafting, bearings, belts, gears, flywheels, etc.; also an introduction to work on speed fluctuation and balancing.

Text book: Design of Machine Elements—Faires.

476. Manufacturing Processes. J. W. Church.

Courses 11, IV Year; 2 hrs. lectures per week, both terms.

A study of metal casting, mechanical working, welding, heat treating, plastics and ply-wood moulding, finishes, machining, and mass production engineering.

477. Manufacturing Processes Laboratory. J. W. Church.

Course 11, IV Year; 3 hrs. laboratory per week, both terms.

Design of castings and forgings and the selection of suitable manufacturing processes from raw material through forming, machining, mass production tooling, gauging, and finishing.

MATHEMATICS

490. Calculus. I. R. Pounder, C. F. A. Beaumont, H. R. Coish, J. J. DelGrande, J. F. Hart, T. E. Hull, J. N. P. Hume, L. Lucas. D. J. Morantz, A. M. Sheppard, K. Shimizu, D. G. Wertheim, H. Wolf.

Courses 1, 2, 3, 4, 6, 7, 8, 8a, 9 and 11, I Year; 2 hrs. lectures per week, both terms.

Course 7, I Year, one 3 hr. period per week, both terms, for problems.

Derivation of the fundamental formulæ of the differential and integral calculus, with early applications to simple problems concerning graphs, areas, volumes, lengths, centres of gravity, and moments of inertia. Problems are dealt with in the drafting room as outlined in subjects 275, 276, 277, 278, 279, 280, 281, 282, and 283. For Course 7, an additional period of three hrs. per week is provided for problems and exercises, conducted by the Department of Mathematics.

491. Calculus. J. D. Burk, H. R. Coish, T. E. Hull, J. N. P. Hume, L. Lucas, D. J. Morantz, A. M. Sheppard, K. Shimizu, N. Shklov, R. A. Staal, H. Sussman, D. G. Wertheim, H. Wolf.

Courses 1, 3, 6, 7, 8, and 11, II Year; 2 hrs. lectures per week, both terms.

Course 7, II Year; one 3 hr. period per week, both terms, for problems.

Continuation of subject 490. The elementary theory reviewed and extended. Special attention to applications with problems in engineering mostly in view. Introduction to the study of simple differential equations. Problems are dealt with in the drafting room as outlined in subjects 284, 285, 286, 287, 288, and 289. For Course 7, an additional period of three hrs. per week is provided for problems and exercises, conducted by the Department of Mathematics.

492. Analytical Geometry. I. R. Pounder, C. F. A. Beaumont, H. R. Coish, J. J. DelGrande, J. F. Hart, T. E. Hull, J. N. P. Hume, L. Lucas, D. J. Morentz, A. M. Sheppard, K. Shimizu, D. G. Wertheim, H. Wolf.

Courses 1, 2, 3, 4, 6, 7, 8, 8a, 9 and 11, I Year; 1 hr. lecture per week, first term, 2 hrs. per week, second term.

The work in Elementary Analytical Geometry covers the more familiar propositions in connection with the straight line, circle, parabola, ellipse, and hyperbola. The subject is treated to illustrate

the general methods of analytical geometry. Introduction to Analytical Geometry of Three Dimensions. In addition, problems are dealt with in the drafting room as outlined in subjects 275, 276, 277, 278, 279, 280, 281, 282, and 283. A part of the problem time for Course 7 listed under subject 490 is devoted to problems in analytical geometry.

493. Spherical Trigonometry. G. T. Horton.

Course 1, II Year; 1 hr. lecture per week, first term.

The derivation of formulæ and their application to the solution of triangles and to practical problems.

Text books: Spherical Trigonometry with Navy and Military Applications—Kells, Kern and Bland. Printed Lecture Notes—G. T. Horton.

494. Least Squares. O. J. Marshall.

Course 1, II Year; 1 hr. lecture per week, second term.

The general principles of probability of errors, elementary problems illustrating the application of Least Squares to the adjustment of observations, impirical constants and formulae.

Text books: Least Squares in Engineering—Coddington and Marshall. Printed Lecture Notes—O. J. Marshall and G. T. Horton.

495. Mathematical Problems. W. J. Webber, D. A. F. Robinson, R. A. Staal.

Course 5, II Year; 3 hrs. problems per week, both terms.

The weekly sheet of prepared problems will be based on the content of courses 504, 506, 507, and will provide training in operating the routine processes of the Calculus and will illustrate these by applications to Mechanics and Geometry. Students will be given an opportunity to have their difficulties in these courses cleared up.

502. Algebra and Calculus. Mrs. R. Brauer, Mrs. L. Infeld.

Courses 5 and 10, I Year; 3½ hrs. lectures per week, both terms.

Polynomials and rational functions, elementary theory of equations, inequalities, determinants, limits, summation of series, binomial, exponential, and logarithmic series, expansions of the circular and hyperbolic functions and their inverses, the methods and operations of the Calculus considered intuitively and illustrated by applications, elementary differential equations.

Text books. Calculus—Sherwood and Taylor. Introduction to the Calculus—Beatty and Jenkins.

503. Analytical Geometry of the Plane. Mrs. R. Brauer, Mrs. L. Infeld.

Courses 5 and 10, I Year; 1½ hrs. lectures per week, both terms.

Cartesian and polar coordinates, transformation of coordinates,

straight lines and curves of the second degree, projective properties of conics, the principle of duality, higher plane curves.

Text book: Analytical Geometry—Nowlan.

504. Differential Calculus. D. A. F. Robinson, J. A. Rottenberg.

Courses 5 and 10, II Year; 3 hrs. lectures per week, both terms.

Differentiation, Taylor's theorem and series for functions of one or more variables, families of curves and surfaces and their differential equations, Jacobians, geometrical and mechanical applications.

Text book: Advanced Calculus—Sokolnikoff.

505. Integral Calculus and Differential Equations. W. J. Webber, G. P. Henderson.

Courses 5 and 10, II Year; 3 hrs. lectures per week, both terms.

The indefinite integral, integration of rational and other special functions, the definite integral, differentiation with respect to a parameter, multiple integration, Fourier's series, geometrical and mechanical applications, approximate integration, introduction to ordinary differential equations.

Text book: Advanced Calculus—Sokolnikoff.

506. Analytical Geometry of Space. R. A. Staal.

Courses 5 and 10, II Year; 1 hr. lecture per week, both terms.

Cartesian and other systems of point coordinates, curves and surfaces and their equations in parametric or non-parametric form, data fixing planes, lines, conics, and quadrics, generating lines and circular sections of quadrics, classification of quadrics, tangent cones to quadrics, metric and projective properties of quadrics, families of quadrics, ruled surfaces and surfaces of revolution.

Text book: Coordinate Geometry—Eisenhart.

507. Differential Equations. Miss C. C. Krieger, L. W. Crompton.

Course 1, III Year; 1 hr. lecture and 1 hr. problem work per week, both terms.

First order equations solvable by quadratures, linear equations of first and second order, linear equations with constant coefficients of higher order, solution in series, Fourier's series.

Text books: Elementary Differential Equations—Kells. Differential Equations—Reddick.

508. Theory of Functions. Miss C. C. Krieger. Mrs. R. Brauer.

Courses 5 and 10, III Year; 1 hr. lecture and 1 hr. problem work per week, both terms.

Complex numbers, limits and series, analytic functions, Cauchy's theorem, Taylor and Laurent series, singularities and their significance, analytic continuation, contour integration, conformal mapping of one plane region on another.

Text books: Functions of a Complex Variable—Phillips. Theory of Functions—Copson. Theory of Functions as applied to Engineering Problems—Rothe, Ollendorff, and Pohlhausen.

509. Differential Equations. Miss C. C. Krieger, Mrs. R. Brauer.

Courses 5 and 10, III Year; 1 hr. lecture and 1 hr. problem work per week, both terms.

First order equations solvable by quadratures, depression of the order, the linear equation, the linear equation with constant coefficients, operator methods, the linear partial differential equation, particular equations of the second order.

Text books: Differential Equations—Piaggio. Intermediate Differential Equations—Rainville. Fourier Series and Boundary Value Problems—Churchill.

MATHEMATICS, APPLIED

520. Theoretical Mechanics. G. deB. Robinson.

Course 5, III Year; 1 hr. lecture and 1 hr. problem work per week, both terms.

A systematic application of mathematical methods to the solution of problems in mechanics, with emphasis on general principles. The problems deal chiefly with the plane motion of particles and rigid bodies. Lagrange's equations are introduced.

Text book: Principles of Mechanics—Synge and Griffith.

521. Differential Equations of Mathematical Physics. A. F. Stevenson.

Courses 5 and 10, IV Year; 2 hrs. lectures per week, both terms.

The underlying theory and important particular equations, including eigenvalues and eigenfunctions, Fourier series, spherical and cylindrical harmonics, vibration of strings, membranes, and rods, sound waves, water waves, equation of heat conduction.

METALLURGY

530. Metallurgy. L. M. Pidgeon.

Course 8, II Year; Courses 2 and 9, III Year; 1 hr. lecture per week, first term.

An introductory course describing the theory and practice of metallurgical operations.

531. Fuels and Combustion, H. U. Ross.

Courses 8 and 8a, II Year; 1 hr. lecture per week, both terms.

Fuels, their use, preparation, calorific value, and combustion.

532. Physical Metallurgy. B. Chalmers.

Course 11, II Year; Courses 3, 5, 7, and 8a, III Year; 2 hrs. lectures per week, second term.

General physical metallurgy, including the common engineering alloys.

534. Metallurgy. L. M. Pidgeon.

Course 8, III Year; 2 hrs. lectures per week, first term; 1 hr. lecture per week, second term.

A general discussion of the fundamental principles of metallurgy, including the production of the more important metals. Metallurgical problems are included in this course.

535. Metallurgy Laboratory. J. E. Toomer.

Course 8, III Year; 6 hrs. continuous laboratory per week, both terms.

Experiments in roasting, smelting, leaching, and retorting designed to illustrate the principles underlying these operations.

536. Principles of Physical Metallurgy. B. Chalmers.

Course 8, III Year; 2 hrs. lectures per week, both terms.

537. Metallography Laboratory. B. Chalmers.

Course 8, III Year; 3 hrs. laboratory per week, both terms.

Preparation and examination of alloys.

538. Metallurgy. L. M. Pidgeon.

Course 2, IV Year; 1 hr. lecture per week, both terms.

The extractive metallurgy of the common metals, together with the calculations necessary to understand the metallurgical processes.

539. Metallurgy Laboratory. J. E. Toomer.

Course 2, IV Year; 6 hrs. continuous laboratory per week for one half of second term.

Similar to subject 535.

540. Metallurgy Problems. L. M. Pidgeon, H. U. Ross.

Course 8, IV Year; 2 hrs. lectures per week, both terms.

Problems of chemical reactions, thermochemistry, electrolysis, vapor pressure, transmission of heat, etc.

541. Metallurgy Laboratory. J. E. Toomer.

Course 8, IV Year; 6 hrs. continuous laboratory per week, first term; 3 hrs. laboratory per week, second term.

Metallurgical analyses of ores, furnace products, and alloys.

542. Non-Ferrous Metallurgy. L. M. Pidgeon.

Course 8, IV Year; 1 hr. lecture per week, both terms.

Extractive metallurgy of the non-ferrous metals.

543. Physical Metallurgy. B. Chalmers.

Course 8, IV Year; 2 hrs. lectures per week, both terms.

A continuation of subject 536, dealing more particularly with the ferrous alloys. Part of the lectures consist of discussions of photo-micrographs.

544. Metallography Laboratory. B. Chalmers.
Course 8, IV Year; 3 hrs. laboratory per week, both terms.
Specimens of the common alloys are prepared, microscopically examined, and photographed.

545. Physical Metallurgy. W. L. Sagar, B. Chalmers.
Course 8, IV Year; 3 hrs. laboratory per week, first term.
The introductory part of this subject is intended to give some familiarity with the experimental study of the elastic and physical properties of iron and steel, and in the use of testing machines and instruments of precision designed for that purpose. Following this, carbon and alloy steels are given different heat treatments. The structures developed are examined and photographed, mechanical tests are made and findings correlated.

546. Physical Metallurgy. B. Chalmers.
Courses 1 and 6, III Year; 1 hr. lecture per week, first term.
Courses 2 and 9, IV Year; 1 hr. lecture per week, first term.
The mechanical properties and heat treatment of steel; cast-iron

547. Heat Treatment of Iron and Steel. B. Chalmers.
Courses 3 and 11, IV Year; 1 hr. lecture per week, both terms.
The principles underlying the heat treatment and mechanical treatment of carbon and alloy steels. Cast iron.

548. Heat Treatment of Iron and Steel Laboratory. B. Chalmers.
Courses 3 and 11, IV Year; 1½ hrs. laboratory per week, second term.
Preparation of specimens of steels and irons, and examining them microscopically.

549. Physical Metallurgy Laboratory. B. Chalmers.
Courses 2 and 9, III Year; 1 hr. laboratory per week, second term.
Specimens of the common alloys are prepared and microscopical examined.

550. Metallurgical Theory. W. C. Macdonald.
Course 8, IV Year; 1 hr. lecture per week, both terms.
A study of equilibria at high temperatures in production metallurgy.

551. Aircraft Materials. L. M. Pidgeon, B. Chalmers.
Course 10, IV Year; 1 hr. lecture per week, both terms.
Alloys of magnesium and aluminum, high strength steels, castings and forgings, together with wood and plastics, as used in aircraft construction.

552. Ferrous Production Metallurgy. H. U. Ross.
Course 8, IV Year; 1 hr. lecture per week, both terms.
Production metallurgy of iron and steel.

CERAMICS

560. Ceramic Minerals. P. M. Corbett.

Course 8a, III Year; 3 hrs. lectures per week, first term; 2 hrs. lectures per week, second term.

Industrial classification, properties, and utilization of non-metallic minerals. Ceramic plant practice is covered in some detail in the second term.

561. Heavy Clay Products Laboratory. P. M. Corbett.

Course 8a, III Year; 6 hrs. laboratory per week, both terms.

The physical properties and thermal characteristics of non-metallic minerals are studied from an industrial standpoint.

562. Ceramics. P. M. Corbett.

Course 8a, III Year; 2 hrs. lectures per week, second term.

The composition of clear and coloured glazes.

563. Ceramic Calculations. J. E. Toomer.

Course 8a, IV Year; 1 hr. lecture per week, first term. (Session 1948-49 only.)

Course 8a, III Year; 1 hr. lecture per week, first term.

Lectures and problems on calculations necessary for the compounding of ceramic bodies and glazes.

564. Ceramics Laboratory. J. E. Toomer.

Course 8a, III Year; 6½ hrs. laboratory per week, first term; 7 hrs. laboratory per week, second term.

Practice in the analysis of non-metallic minerals.

565. Refractories and Ceramic Bodies. P. M. Corbett.

Course 8a, IV Year; 2 hrs. lectures per week, first term; 1 hr. lecture per week, second term.

Composition of bodies made by using non-metallic minerals, with special reference to refractories, whiteware, and porcelain.

566. Glass and Enamels. P. M. Corbett.

Course 8a, IV Year; 1 hr. lecture per week, both terms.

Composition and manufacture of glass and iron enamels.

568. Whitewares and Enamels Laboratory. P. M. Corbett.

Course 8a, IV Year; 6 hrs. laboratory per week, both terms.

Advanced work on the compounding and testing of non-metallic mineral products.

569. Building Materials; Ceramic. P. M. Corbett.

Course 4, IV Year; 1 hr. lecture per week, second term.

Composition, manufacture, properties, and tests of ceramic building materials.

572. Introductory Ceramics. P. M. Corbett.
Course 8a, II Year; 2 hrs. lectures per week, first term.
A descriptive course to cover all the branches of the ceramic industry.

573. Refractories and Metallurgy. P. M. Corbett.
Course 8, III Year; 1 hr. lecture per week, both terms.
Theories and applications of refractories in metallurgical processes.

GEOLOGICAL SCIENCES

MINERALOGY AND PETROGRAPHY

580. Elementary Mineralogy. R. E. Deane.
Courses 2 and 9. I Year; 2 hrs. lectures per week, second term.
Course 5g, III Year; 2 hrs. lectures per week, first term.
An introductory course in general and descriptive mineralogy.
Text book: Dana's Manual of Mineralogy—Hurlbut.

581. Elementary Mineralogy Laboratory. R. E. Deane.
Courses 2 and 9, I Year; 1 hr. laboratory per week, second term.
Course 5g, III Year; 1 hr. laboratory per week, first term.
A practical course to accompany subject 580.
Reference book: Dana's Manual of Mineralogy—Hurlbut.

583. Introductory Mineralogy. R. E. Deane.
Courses 6, 8 and 8a, I Year; 2 hrs. lectures and laboratory per week, second term.
A brief study of the common minerals.
Reference book: Dana's Manual of Mineralogy—Hurlbut.

585. Lithology. R. E. Deane.
Courses 2 and 9, II Year; Course 5g, III Year; 1 hr. lecture and laboratory per week, both terms.
A macroscopic study of rock-forming minerals and rocks.
Text book: Handbook of Rocks—Kemp-Grout.

587. Blowpipe Analysis. R. E. Deane.
Courses 2 and 9, II Year; 2 hrs. laboratory per week, first term.
Determination of minerals by means of the blowpipe and from physical properties.
Reference book: Dana's Manual of Mineralogy—Hurlbut.

589. Elementary Optical Mineralogy. V. B. Meen.
Courses 2 and 9, II Year; Courses 5g and 8a, III Year; 1 hr. lecture and laboratory per week, second term.
Reference book: Optical Mineralogy—Rogers and Kerr.

590. Petrology Laboratory. V. B. Meen.
Course 2, III Year; 2 hrs. laboratory per week, second term.
Continuation of subject 585, with some consideration of the microscopic properties of minerals and rocks.
Text book: Petrology for Students—Harker.

592. Lithology. V. B. Meen.

Course 1, III Year; 2 hrs. lectures and laboratory per week, first term.

A study of rocks and rock-forming minerals.

Text book: Handbook of Rocks—Kemp-Grout.

594. Petrography. W. W. Moorhouse.

Course 9, III Year; Course 5g, IV Year; 1 hr. lecture per week, both terms.

Microscopic characters of the rock-forming minerals in thin sections, and description and classification of rocks, continuing subjects 585 and 589.

Text books: Optical Mineralogy—Rogers and Kerr. Petrology for Students—Harker.

595. Petrography Laboratory. W. W. Moorhouse.

Course 9, III Year; Course 5g, IV Year; 2 hrs. laboratory per week, both terms.

Microscopic petrography, to accompany subject 594.

Text books: As in subject 594.

596. Optical Mineralogy Laboratory. M. A. Peacock.

Courses 8a and 9, IV Year; 2 hrs. laboratory per week, both terms.

Determination of the non-opaque minerals by the immersion method.

Reference books. Optical Crystallography—Wahlstrom. The Microscopic Determination of the Non-opaque Minerals—Larsen and Berman.

597. Mineralography Laboratory. A. R. Graham.

Course 9, IV Year; 2 hrs. laboratory per week, both terms.

A study of the common ore minerals in polished sections.

Reference book: Microscopic Determination of the Ore Minerals —Short.

598. Morphological Crystallography. M. A. Peacock.

Course 5s, IV Year; 1 hr. lecture per week, both terms.

A course on the thirty-two crystal classes, with reference to natural and artificial crystals.

Text book: The Form and Properties of Crystals—Dale.

MODERN LANGUAGES

610. English. W. J. T. Wright.

Courses 1, 2, 3, 5, 6, 7, 8, 8a, 9, 10 and 11, I Year; 1 hr. lecture per week, both terms.

The expression of ideas and the compilation and writing of engineering reports and letters; technical exposition; the necessity of accurate expression in professional writing; the value of reading.

613. German. T. Hedman.
Course 6, II Year; 1 hr. lecture per week, both terms.

614. German. T. Hedman.
Course 6, III Year; 1 hr. lecture per week, both terms.
An advanced course in scientific German.

615. German. T. Hedman.
Course 6, IV Year; 1 hr. lecture per week, both terms.
An advanced course in scientific German. Translation of scientific articles and treatises.

PHYSICAL TRAINING

640. Physical Training.
All courses, I and II Years.
The requirements for Physical Training are outlined in Section XIV.

PHYSICS

650. Properties of Matter; Mechanics and Heat. J. Convey, J. Reekie.
Courses 5 and 10, I Year; 4 hrs. lectures, per week, both terms.
In addition to the work in the divisions indicated in the title, the subject also includes lectures and problems on calculations for science students involving curve plotting and curve fitting, and the use of the elementary calculus and statistics.
Reference books: Dynamics—Duncan and Starling. Mechanics of Fluids—Barton. Mechanics—Sears. Properties of Matter—Wagstaff. Heat—Stewart and Satterly (ed. Archer). Heat—Noakes. Mathematical and Physical Tables—Clark. Calculus Made Easy—Thompson. Theory of Measurements—Tuttle and Satterly.

651. Properties of Matter; Mechanics and Heat Laboratory. J. Convey.
Courses 5 and 10, I Year; 3 hrs. laboratory per week, both terms.
Supplementary to subject 650.

652. Elementary Magnetism and Electricity. J. Reekie.
Courses 5 and 10, II Year; 1 hr. lecture per week, first term; 2 hrs. lectures per week, second term.
Fundamental theory of magnetism and electricity, including the introduction of electron theory and alternating currents.
Reference books: Advanced Text-book of Magnetism and Electricity—Hutchinson. Electricity and Magnetism—Starling.

653. Elementary Light. J. Convey.
Courses 5 and 10, II Year; 1 hr. lecture per week, both terms.
Fundamental theory of light, including treatment of interference, diffraction, polarized light, and the introduction of geometrical optics.
Reference books: Light for Students—Edser. Introduction to Physical Optics—Robertson. Optical Measuring Instruments—Martin.

654. Acoustics. J. Convey.

Courses 5 and 10, II Year; 1 hr lecture per week, first term.

Fundamental theory of acoustics, including elementary treatment of architectural acoustics.

655 Physics Laboratory (Magnetism and Electricity, Light and Acoustics).

Course 5 and 10, II Year; 3 hrs. laboratory per week, first term; 6 hrs. laboratory per week, second term.

Work carried out under the direction of the staff in Physics, covering lectures dealt with in subjects 652, 653 and 654.

656. Mathematical Methods in Physics I. H. L. Welsh.

Course 5, III Year; 1 hr. lecture per week, both terms.

Analysis of scalar and vector fields with applications to mechanics and hydromechanics. Complex numbers and their use in two-dimensional theory of fields and in problems of mechanica vibrations.

657. Properties of Matter. John Satterly.

Course 5, III Year; 2 hrs. lectures per week, both terms.

Advanced work on properties of matter, dealing with gravitation, elasticity, viscosity, surface tension, and kinetic theory of gases.

Reference books: Properties of Matter—Poynting and Thomson. General Properties of Matter—Newman and Searle. Applied Mathematics—Perry. Experimental Physics—Searle. Practical Physics—Watson. The Mechanical Properties of Fluids—Drysdale and others.

658. Heat. John Satterly.

Course 5, III Year; 1 hr. lecture per week, both terms.

Thermometry and pyrometry; absolute scale of temperature, mechanical equivalent of heat, kinetic theory of gases, equations of state, low temperature work, specific heats, vaporization, fusion, expansion, transfer of heat by conduction and convection; radiation and radiation pyrometry, the second law of thermodynamics and its simple applications.

Reference books: Heat and Thermodynamics — Roberts. Methods of Measuring Temperature—E. Griffiths. A Textbook on Heat. Parts I and II—Allen and Maxwell.

659. Physical Laboratory.

Course 5, III Year; 3 hrs. laboratory per week, both terms.

Experiments illustrating the principles involved in the two preceding subjects.

660. Optics. R. Richmond.

Courses 5i and 5s, III Year; 1 hr. lecture per week, both terms.

Optics. The theory of paraxial rays and aberrations in optical

instruments. Theory of prism spectrographs: dispersion, resolving power, and light power.

Reference books: Applied Optics and Optical Design, Part One—Conrady. The Principles of Optics—Hardy and Perrin. Fundamentals of Optical Engineering—Jacobs. Experimental Spectroscopy—Sawyer.

661. Optics. R. Richmond.

Courses 5i and 5s, III Year; 3 hrs. laboratory per week, first term.

Supplementary to subject 660.

663. Atomic Physics. Miss E. J. Allin, H. J. C. Ireton, H. L. Welsh.

Course 5, IV Year; 2 hrs. lectures per week, both terms.

Introduction to quantum theory, atomic, molecular and nuclear physics.

Text books: Introduction to Modern Physics—Richtmyer and Kennard. The 'Particles' of Modern Physics—Stranathan.

664. Mathematical Methods in Physics II. C. Barnes.

Course 5, IV Year; 2 hrs. lectures per week, first term.

Vibrations of systems of one and two degrees of freedom. Formulation of general laws of fluid motion, elasticity, wave propagation, and heat conduction. Application of function theory, Cartesian tensors, and calculus of variations in classical problems.

665. Physical Laboratory. H. J. C. Ireton.

Course 5c, IV Year; 3 hrs. laboratory per week, both terms.

Course 5s, IV Year; 9 hrs. laboratory per week, first term; 12 hrs. laboratory per week, second term.

Accompanying the lecture subjects 663, 664, 666, and 669.

666. Advanced Optics. M. F. Crawford.

Course 5s, IV Year; 2 hrs. lectures per week, second term.

Diffraction, interference, and polarisation.

Text books: Physical Optics—Wood. Diffraction of Light, X-Rays, etc.—Meyer. Applications of Interferometry—Williams Cours d'Optique—Bruhat.

667. Theory of Potential. C. Barnes.

Course 5c, III Year; 1 hr. lecture per week, both terms.

The theory of the Newtonian potential leading to the solution of simple boundary-value problems connected with the Laplace equation in gravitation, electrostatics, and heat conduction.

669. Analysis of Materials by Spectrographic and X-Ray Methods.

Course 5s, IV Year; 1 hr. lecture per week, both terms.

Qualitative and quantitative methods of spectro-chemical analysis of materials. The physical properties of X-rays, their production and applications to crystal structure.

Reference books: Applied X-Rays—Clark. Chemical Spectroscopy—Brode. Optical Methods of Chemical Analysis—Gibb.

670. Exploration Geophysics. A. A. Brant, J. H. Hodgson.
Course 5g, IV Year; 2 hrs. lectures per week, both terms.

Physical principles underlying geophysical methods used in locating mineral deposits. Particular attention is given to magnetic, electrical, electromagnetic, gravitational, seismological, theremometric, and radioactive methods.

Reference books: Geophysical Exploration—Heiland. Exploration Geophysics—Jakosky. Imperial Geophysical Exploration Survey, Broughton—Edge and Laby. Applied Geophysics—Eve and Keys.

671. Exploration Geophysics. A. A. Brant, J. H. Hodgson.
Course 9, IV Year; 2 hrs. lectures per week, both terms.

Elementary physical principles underlying geophysical methods used in locating mineral deposits. Particular attention is given to magnetic, electrical, electromagnetic, gravitational, seismological, theremometric, and radioactive methods.

Reference books: Geophysical Exploration—Heiland. Exploration Geophysics—Jakosky. Imperial Geophysical Exploration Survey, Broughton—Edge and Laby. Applied Geophysics—Eve and Keys.

672. Geophysics. A. A. Brant, J. H. Hodgson.
Course 5g, IV Year; 9 hrs. laboratory per week, both terms.
A laboratory course accompanying subject 670.

673. Geophysics. A. A. Brant, J. H. Hodgson.
Course 9, IV Year; 6 hrs. laboratory per week, both terms.
A laboratory course accompanying subject 671.

674. Physical Laboratory. H. J. C. Ireton.
Course 5i, IV Year; 3 hrs. laboratory per week, both terms.
Accompanying subject 663..

675. Physics of the Earth. J. T. Wilson, J. H. Hodgson.
Course 5g, IV Year; 2 hrs. lectures per week, both terms.

Basic considerations of gravitation; the figure of the earth and isostacy; terrestrial magnetism and atmospheric electricity; seismology; internal structure and constitution of the earth; radioactivity, geothermal heat and the age of the earth.

PRACTICAL EXPERIENCE

690. Practical Experience.
Course 1.

Every student in Civil Engineering is urged to obtain the maximum amount of practical experience possible, during the summer vacations of his course. He must, before graduation, present satisfactory evidence of having had an experience of at least 600 hours on work acceptable to the Department.

691. Practical Experience.

Course 2.

Every student in Mining Engineering is required to present, before graduation, satisfactory evidence of having had at least six months' practical experience in work connected with Mining, Metallurgy, or Geology, for which he must have received regular wages.

The time may be spent in geological survey, ore dressing, smelter, or lixiviation works, in prospecting, or on any work in or about a mine other than as an office man or clerk. Prospecting will count only one-half (e.g., four months' prospecting will be counted as two months) and must not be submitted for more than three of the six months. Not more than three months on geological surveys or in assaying will be accepted as part of the six months. It is important to note that this experience may be obtained before the student is admitted to the University.

692. Practical Experience.

Course 3.

Every student in Mechanical Engineering is required to spend 1200 hours in mechanical work satisfactory to the Department. Half of this work is required to be done before February of his Third Year and the balance before February of his Fourth Year. Proof is to be given the Department before the dates mentioned.

All or any part of this shop work may be completed before the student enters the University, and he is urged to complete all of it at as early a date in his course as possible.

Failure to meet the specified requirements within the time set will result in a condition in shop work.

Certificate forms for this work may be obtained from the Department of Mechanical Engineering.

(*a*) Third Year—600 hours.

The student is required to obtain this practical experience in industry, preferably in the foundry, the forge shop, and the machine shop. Such work assists the student in his understanding of the lecture and laboratory work throughout his entire course in Mechanical Engineering, and particularly the design work in his Third and Fourth Years.

Instruction regarding the type of work which is acceptable, and any special requirements, will be given by the Department to the student during his Second Year.

(*b*) Fourth Year—the balance of 1200 hours.

This is a continuation of the work outlined for the Third Year.

Instruction regarding the type of work which is acceptable, and any special requirements, will be given by the Department to the student during his Third Year.

693. Practical Experience.

Course 4.

Every student in the School of Architecture is required to spend at least 12 months (1,900 hours) in satisfactory practical work and evidence of its completion must be submitted before the granting of a degree. The work is normally done during the summer vacations. The value of "on the job" experience is emphasized and approximately four of the 12 months should be spent on building sites and in contact with the processes of construction. Experience in the office of an engineer is also valuable, but at least 4 months (650 hours) must be spent in the office of a practising architect.

695. Practical Experience.

Course 7.

Every student in Electrical Engineering is required to submit, before graduation, satisfactory evidence of having had at least 1200 hours' experience in work connected with engineering practice. Certificate forms may be obtained from the Department of Electrical Engineering and the completed certificates should be returned to the Department as soon as possible after the completion of each period of work.

696. Practical Experience.

Course 9.

Every student in Mining Geology is required to submit, before graduation, satisfactory evidence that he has spent at least six months in field work. This may consist of prospecting, development or underground work or service on geological field parties, and at least half of the time should be spent underground.

698. Practical Experience.

Course 11.

Each student in this course is required to spend 1200 hours doing practical work, before graduation. This time should preferably be spent in the actual performance of manufacturing or constructional operations in industrial plants or engineering enterprises. Such experience will be valuable in promoting a better understanding of lectures and laboratory work and will assist the student in appreciating the workers' viewpoint.

SURVEYING

All students taking Field Work in Courses 710 to 720, inclusive, will be required to use Departmental Field Books.

710. Surveying. W. M. Treadgold, O. J. Marshall, T. L. Rowe, H. L. Macklin, G. T. Horton, G. R. K. Lye, J. M. Burk.

Courses 1, 2, 3, 4, 5, 6, 7, 8, 8a, 9, 10 and 11, I Year; 1 hr. lecture per week, first term.

General principles and practice of surveying with the chain, the transit, and the level, with special attention given to co-ordinative surveying.

Text books: Plane Surveying—Tracy. Elementary Surveying—Breed and Hosmer. Surveying—Breed. Printed Notes on Elementary Surveying—The Staff in Surveying.

712. Field Work. W. M. Treadgold, O. J. Marshall, T. L. Rowe, H. L. Macklin, G. T. Horton, G. R. K. Lye, J. M. Burk.

Courses 1, 2, 3, 4, 5, 6, 7, 8, 8a, 9, 10 and 11, I Year; 3 hrs. per week, first term.

Practice in chaining; a complete survey of a piece of land with the chain and transit; keeping of field notes; the use of the transit in surveying closed figures and traverse lines, and in ranging straight lines; plotting by latitudes and departures and otherwise computing areas; instrumental work with the level; use of level and transit in setting out a proposed building and calculating the volume of excavations required.

714. Surveying. G. T. Horton.

Course 1, II Year; 1 hr. lecture per week, both terms

Simple, reverse, and compound curves as applied to railroad and highway surveying. Stadia, plane table, and photographic surveying as applied to topographic work, and the main features of mine, hydrographic, and aerial surveying

Text books: Searles, Allen (Field books for Engineers). Theory and Practice of Surveying—Davis, Foote and Rayner. Surveying—Breed and Hosmer. Printed Lecture Notes—W. M. Treadgold.

715. Surveying. H. L. Macklin.

Courses 2 and 9, II Year; 1 hr. lecture per week, both terms.

Mine surveying, with problems related thereto. Simple curves, stadia and plane table topographical surveying.

Text books: Surveying—Breed and Hosmer. Mine Surveying—Durham. Introduction to Mine Surveying—Staley.

716. Field Work. W. M. Treadgold, O. J. Marshall, H. L. Macklin, G. T. Horton, G. R. K. Lye, J. M. Burk.

Course 1, II Year; 8 hrs. per week, first term.

Courses 2 and 9, II Year; 6 hrs. per week, first term.

Adjustments of the transit and level, minor problems in triangulation and traversing, levelling and plane table practice, curves and topography.

717. Construction Surveying. W. M. Treadgold.

Course 1, III Year; 1 hr. lecture per week, both terms.

Construction surveys are taken up under the following headings, and the work is treated as applying equally to railroads, highways, canals, transmission lines, etc.

Earthwork:

(*a*) Cross sectioning.

(*b*) Computation of volume.

(*c*) Mass or haul diagram.

Transition and Vertical curves (including super-elevation).

Railway turnouts and sidings.

Layout of roads and sewers.

Text books: Field Engineering—Searles. Railroad Curves and Earthwork—Allen. Route Surveying—Pickles and Wiley. Printed Notes—W. M. Treadgold.

718. Geodesy and Map Projections. O. J. Marshall.

West Indies Surveyors; 1 hr. lecture and 2 hrs. laboratory per week, second term.

Elementary geodesy, figure of the earth, spherical excess etc. Computation of geographic position and plane co-ordinates on. typical systems of map projections.

720. Survey Camp. W. M. Treadgold, J. W. Melson, T. L. Rowe, H. L. Macklin, G. T. Horton, G. B. Langford, W. W. Moorhouse.

Courses 1, 2 and 9, III Year.

Course 1........... May 1 to May 29—Ajax or
Aug. 21 to Sept. 18—Dorset

Courses 2 and 9..... May 1 to May 29—Gull Lake or
Aug. 21 to Sept. 18—Gull Lake

This course includes:

(*a*) Secondary Triangulation and Base Line Measurements.

(*b*) Stadia, Plane Table and Boundary Traverses.

(*c*) Highway and Railway Location.

(*d*) Cross Sectioning and Computation of Earthwork.

(*e*) Hydrographic Surveying.

(*f*) Stadia and Plane Table Topography.

(*g*) Mine Surveying.

(*h*) Observations for Time, Azimuth, and Latitude.

(*i*) Geological Survey.

Students in Courses 1, 2 and 9 will be required to take the Survey Camp between the Second and Third Years; on failure to do so, this subject will be carried as a supplemental in the Third Year.

THESIS

730. Thesis.

Course 1, IV Year; 2hrs. per week, second term.

Each student of the Fourth Year, Course 1, is required to prepare and present a thesis on an approved subject, in both oral and written form. Instructions regarding the form of the thesis, and the selection of subject, are given to students at the end of their Third Year. The written thesis must be submitted not later than the last day of the Fall term of the Fourth Year of study. Oral presentation of the theses is arranged for the Spring term during regularly assigned lecture periods.

731. Thesis.

Course 2, IV Year.

Each student is required to prepare a thesis on a subject approved by the Head of the Department of Mining Engineering. Instructions regarding this thesis will be given to the students at the end of the Third Year.

732. Thesis.

Course 3, IV Year.

Printed instructions regarding thesis requirements are issued to each student by the Department of Mechanical Engineering, giving full particulars.

733. Thesis.

Course 5, IV Year.

Each student in the Fouth Year will be required to prepare a thesis on a subject approved by the Committee Administering the Course in Engineering Physics.

734. Thesis.

Course 6, IV Year.

In this subject, to which about one-third of the time of the year is devoted, each student is assigned a research problem by a member of the staff, under whose direction he carries out the necessary laboratory work. This involves a search of the chemical literature respecting the problem, and devising experimental procedures. At the end of the session a thesis is written embodying the results of his search of the original literature and his own experimental work.

This is intended to require the student, on an individual basis, to apply the knowledge gained in his previous courses, and to encourage the development of initiative. Also, for those students who go on to the Graduate School or into industrial research, it is intended as a preliminary training.

In those cases where in the opinion of the staff it would be advantageous for the student to do his research work in a closely allied field, such as electrochemistry, metallurgy, applied physics, etc., the Department will make the necessary arrangements, where possible, with the other Departments concerned.

735. Thesis.

Course 7, IV Year.

Each student is required to prepare a thesis on a subject approved by the Head of the Department of Electrical Engineering. Instructions regarding the form of the thesis will be given to the students at the end of the Third Year.

736. Thesis.

Course 8, IV Year.

Each student in the Fourth Year must prepare a thesis on a subject and in a form approved by the Head of the Department of Metallurgical Engineering. This thesis is based upon library and laboratory work.

737. Thesis.

Course 8a, IV Year.

A written report of approximately 6000 words, on a subject approved by the Department. Material for this report is obtained from laboratory and library work, which is carried out under the supervision of a member of the staff.

738. Thesis.

Course 9, IV Year; 6 hrs. per week, both terms.

A report on an investigation made by the student. It is intended to test his ability to make an independent field or laboratory study of some geological problem. The problem chosen must be approved by the Committee Administering the Course in Mining Geology, and plans for the thesis completed not later than November 1st of the student's Fourth Year.

739. Thesis.

Course 10, IV Year.

Each student of the Fourth Year must prepare a written thesis on an approved subject of a length not less than 6000 words. This thesis is to be finished and submitted for binding on or before January 15th.

740. Thesis.

Course 11, IV Year.

Each student in the Fouth Year, Course 11, is required to prepare and present, in both oral and written form, a thesis on an approved subject in the field of management. Instructions regarding the form of the thesis and the selection of subject are given toward the end of the Third Year.

SECTION X. EXAMINATIONS

ANNUAL EXAMINATIONS

1. Annual examinations will be held in April except as provided in paragraph 2 below.

2. Annual examinations will be held at the beginning of the second term in all subjects completed during the first term.

3. Promotions from one year to another are made on the results of term work and the annual examinations. A student proceeding to a degree must pass in all term work and examinations in all subjects of his course, and at the periods arranged by the Council.

4. The pass marks required on written examinations and laboratory work of all departments are 50 per cent, with an average of 55 per cent on written examinations and an average of 55 per cent on laboratory work. Candidates who have attained the required average and who have failed in not more than two subjects will be required to pass supplemental examinations in those subjects to secure pass standing.

5. Honours will be granted a student who, at the Annual Examinations, passes in all written and laboratory subjects, and who also obtains 75 per cent of the total number of marks allotted to the subjects in his course.

6. Honour graduate standing will be granted to those who obtain honours in the final year and in one previous year.

7. Candidates who fail to secure promotion in the First and Second Years will not be allowed to repeat the work of the year until at least one academic year has elapsed.

8. A student who fails in the work of any year may petition the Council to be allowed to repeat the work of the year. If the petition is granted, registration will be provisional only and will be so endorsed on his registration card.

9. A student will not be allowed to repeat the work of more than one year in his entire undergraduate course.

10. Candidates who are repeating the work of any year will be required to take again the whole course of instruction in the year in which they fail before presenting themselves a second time for examination.

11. A student who, in either term of the session, fails to perform satisfactorily the work of his course may not be allowed to present himself at the final examinations of the year.

12. A student should submit to Council immediately after its occurrence, evidence of any illness or mishap which occurs during the session; any petition for leniency on account of such incidents may be refused consideration if received after the third day following the last day of examinations.

13. A student who has failed to complete satisfactorily the course in Physical Training prescribed for the First Year will not be permitted to register in the Third Year; and a student who has failed to complete satisfactorily the course in Physical Training prescribed for the Second Year will not be permitted to register in the Fourth Year.

14. A student will not be allowed to write any examinations if he has not paid all fees and dues for which he is liable at that time.

SUPPLEMENTAL EXAMINATIONS

1. The supplemental written examinations will begin on the 30th day of August, 1948. Application (on the prescribed form) to take such examinations, including practical ones, must be received from the candidate by the Secretary of the Faculty not later than July 15th, and the fee named in Sec. VI, para. 11, received by the Chief Accountant not later than September 1st. Council reserves the right to reject applications of, or impose penalties upon, those failing to comply with these requirements. Arrangements will be made to to conduct supplemental examinations at the Survey Camp for those students in attendance at the Camp.

2. If a candidate desires to write upon an annual examination as a supplemental, his application must be received by the Secretary and his fee by the Chief Accountant, for the January examinations not later than December 1st and for the April examinations not later than March 1st.

3. Except under very exceptional circumstances, pass standing must be obtained in all written supplementals before entering the next higher year, and in all laboratory supplementals before or during the Session of the next higher year as may be required by the Department concerned.

TERM EXAMINATIONS

Term examinations may be held in any subject and at any time at the discretion of the instructor, or by order of the Council, and the results of such examination may, if the Council so decides, be incorporated with those of the annual examinations in the same subjects.

EX-SERVICE PERSONNEL

The foregoing regulations are applicable to all students of the Faculty. Special problems of students who have served in His Majesty's Armed Forces will be considered individually by the Council.

EXTRA-CURRICULAR ACTIVITIES AND ACADEMIC CREDIT

It is in general desirable for students to engage to a reasonable extent in extra-curricular activities in order that they may not become too narrowly professional in interests and outlook, but it will be obvious that no academic credit or consideration can be given for such activities. Some offices in student organizations require quite large amounts of time for the proper performance of the duties connected with them, and it is therefore strongly recommended that students, particularly those whose academic records are not high, consult a senior member of Staff before allowing themselves to be nominated for such offices.

SECTION XI. SCHOLARSHIPS, AWARDS AND LOANS

Through the generosity of friends of the University, governments and commercial organizations, encouragement has been given to both undergraduate and graduate work in the various branches of engineering studies by establishing the following scholarships, prizes, bursaries, and medals.

Matriculation students are advised to consult the University of Toronto Calendar on Admission Requirements and Scholarships for complete details of awards available to students entering this Faculty.

Where it is necessary to make application for an award it is so stated in the description and particulars are given as to how the application should be made. In all other cases the award is made on the recommendation of the Faculty Council and no application is necessary.

A student will not be allowed to hold more than one scholarship of those marked by an asterisk, or otherwise designated, in any one year. The student obtaining highest standing in his year and a student winning more than one award will be so shown in the published results.

The funds available from any undergraduate scholarship will not be paid to the winner unless he registers and is in regular attendance in the appropriate course of the Faculty of Applied Science and Engineering for the academic year immediately following the award. The Council may, at its discretion, award unallocated funds to a suitable candidate in the same or later session.

Name	Amount	Application required	Available only to a limited group or single course	See page
AVAILABLE TO STUDENTS ENTERING THE FIRST YEAR				
Applied Science Bursaries.....	$2000	Yes	No	165
Emerson Wickett Memorial Scholarship...............	$100	Yes	No	165
Hagarty Memorial Scholarship.	$60	Yes	Yes	165
U.T.S. Engineering Scholarship.	$250	Yes	Yes	166
The Leonard Foundation Scholarships..............		Yes	Yes	166
The Robert Simpson Company Scholarship...............	$100	Yes	Yes	166
O.H.A. War Memorial Scholarship.....................	$200	Yes	Yes	167
Engineering Alumni Admission Scholarship................	$300	Yes	No	167
Students' Administrative Council Admission Scholarship.......	$350	Yes	Yes	168
Ontario-Minnesota Pulp and Paper Co. Ltd. Bursaries....	$500	Yes	Yes	168
Algoma Ore Properties Limited Admission Scholarships.....	$4800	Yes	Yes	169

Name	Amount	Application required	Available only to a group or single course	See page
AVAILABLE TO STUDENTS COMPLETING THE FIRST YEAR				
University Alumni Federation War Memorial Scholarships	$200	Yes	No	169
*Baptie Scholarship............	$100	No	Yes	169
MacLennan-MacLeod Memorial Prize.....................	$25	No	No	170
*Ransom Scholarship in Chemical Engineering...............	$150	No	Yes	170
T. H. Bickle Prize	$30	No	Yes	170
*John M. Empey Scholarship...	$100	No	No	171
Garnet W. McKee-Lachlan Gilchrist Scholarship in Engineering Physics............	$60	No	Yes	171
*Wallberg Undergraduate Scholarships...............	$600	No	No	171
Association of Professional Engineers of the Prov. of Ontario Scholarships	$225	No	Yes	174
Hugh Gall Award............	$100	Yes	No	171
Carl Swan Award.............	$80	No	No	172
University Naval Training Division Bursaries............	$100	Yes	Yes	172
S. Ubukata Fund.............		Yes	Yes	173
Algoma Ore Properties Limited Undergraduate Scholarships.	—	No	Yes	172
University of Toronto General Bursaries.................	—	Yes	No	188
Dominion-Provincial Student-Bursaries.................	—	Yes	No	188
AVAILABLE TO STUDENTS COMPLETING THE SECOND YEAR				
Rhodes Scholarship...........	£400	Yes	No	182
University Alumni Federation War Memorial Scholarships	$200	Yes	No	169
*Harvey Aggett Memorial Scholarship...............	$75	No	No	173
Ontario Association of Architects Scholarship..........	$100	No	Yes	174
J. A. Findlay Scholarship......		No	Yes	174

Name	Amount	Application required	Available only to a limited group or single course	See page
*Association of Professional Engineers of the Province of Ontario Scholarships.......	$175	No	Yes	174
T. H. Bickle Prize...........	$30	No	Yes	170
Women's Mining Association Scholarship..............	$300	Yes	Yes	175
*Garnet W. McKee-Lachlan Gilchrist Geophysics Scholarships....................		No	Yes	175
*John M. Empey Scholarship...	$100	No	No	171
W. G. Millar Memorial Scholarship.....................	$250	Yes	Yes	176
*Wallberg Undergraduate Scholarships..............	$300	No	No	171
Ardagh Prize	$50	No	Yes	176
Algoma Ore Properties Limited Undergraduate Scholarships.	—	No	Yes	172
James L. Morris Memorial Prize	$60	No	Yes	176
University of Toronto General Bursaries................	—	Yes	No	188
Dominion-Provincial Student-Aid Bursaries............	—	Yes	No	188
Eastern Steel Products Limited Scholarship	$350	Yes	Yes	177
AVAILABLE TO STUDENTS COMPLETING THE THIRD YEAR				
Rhodes Scholarship...........	£400	Yes	No	182
*Boiler Inspection and Insurance Company Scholarship......	$150	No	Yes	177
University Alumni Federation War Memorial Scholarships	$250	Yes	No	169
*Jenkins Scholarship in Engineering....................	$200	No	No	177
Heating and Ventilating Engineers Prize..............	$25	No	No	178
E.I.C. Prize.................	$25	No	Yes	178
Engineering Society Semi-Centennial Award.........	$75	No	No	178
J. A. Findlay Scholarship......		No	Yes	174
*Association of Professional Engineers of the Province of Ontario Scholarships	$225	No	Yes	174

Name	Amount	Application required	Available only to a limited group or single course	See page
T. H. Bickle Prize	$ 30	No	Yes	170
Women's Mining Association Bursary	$150	Yes	Yes	175
Archie B. Crealock Memorial Prize	$ 25	No	Yes	178
*John M. Empey Scholarship	$100	No	No	171
Hudson Bay Mining and Smelting Company Limited Scholarships	$800	Yes	Yes	179
*Wallberg Undergraduate Scholarships	$300	No	No	171
Toronto Brick Company Prizes	$100	No	Yes	179
Algoma Ore Properties Limited Undergraduate Scholarships	—	No	Yes	172
Chemical Institute of Canada Prize	$25	No	Yes	179
University of Toronto General Bursaries	—	Yes	No	188
Dominion-Provincial Student-Aid Bursaries	—	Yes	No	188
AVAILABLE TO STUDENTS COMPLETING THE FOURTH YEAR				
B.A.A.S. Medal		No	No	179
Heating and Ventilating Engineers Prize	$25	No	No	178
INCO. Scholarship	$500	Yes	Yes	179
Hobbs Glass Limited Scholarship	$250	No	Yes	180
"Second Mile Engineer" Award	$100	No	Yes	180
Henry G. Acres Medal	—	No	Yes	180
University of Toronto General Bursaries	—	Yes	No	188
Dominion-Provincial Student Aid Bursaries	—	Yes	No	188
AVAILABLE TO STUDENTS COMPLETING THE FIFTH YEAR				
Toronto Architectural Guild Medal		No	Yes	181
Anaconda American Brass Limited Prizes	$300	No	Yes	181

Name	Amount	Application required	Available only to a limited group or single course	See page
R.A.I.C. Medal		No	Yes	181
Available to Graduates				
Rhodes Scholarship	£400	Yes	No	182
1851 Exhibition Science Research Scholarships	£275	Yes	Yes	182
McCharles Prize	$1000	No	No	183
Nipissing Mining Research Fellowships	$1100	Yes	No	184
H. W. Price Research Fellowship in Electrical Engineering	—	Yes	Yes	184
C.I.L. Fellowship in Chemistry	$750	Yes	Yes	184
T. A. Russell Memorial Research Fellowship	$1000	Yes	Yes	185
Consolidated Mining and Smelting Company Fellowship	$750	Yes	No	185
Canadian Institute of Steel Construction Research Fellowship	$1200	Yes	No	185
Canadian Lumbermen's Association Timber Research Fellowship	$1000	Yes	No	185
Imperial Oil Graduate Research Fellowships	$4000	Yes	Yes	186
George T. Goulstone Fellowship in Architecture	—	Yes	Yes	186
Wallberg Research Fellowships	$3000	Yes	No	186
Spruce Falls Power and Paper Company Limited Fellowships	$750	Yes	No	187
Algoma Ore Properties Limited Graduate Fellowships	—	Yes	Yes	187
1940 Toronto Fund	—	Yes	No	187
Raymond Priestley Fellowship	£450	Yes	No	188
Royal Institution of Great Britain Science Research Scholarships	£350	Yes	No	188

NOTE—On account of the continued tendency towards lower rates of interest it is possible that the value of certain scholarships or prizes at the time of payment may prove to be less than the amount stated in the calendar.

APPLIED SCIENCE BURSARIES

To assist promising students in the secondary schools who would otherwise be prevented for financial reasons from entering the Faculty of Applied Science, the Board of Governors has allocated $2000 to assist such persons to commence work at the University. A number of Bursaries, each amounting to approximately $175, will be awarded in 1948 to those applicants who are considered by the Council of the Faculty to be most eligible. An applicant must have obtained First Class Honours in Mathematics and a high proficiency record in the remaining subjects at the Grade XIII examinations for the Province of Ontario, or their equivalent.

Each applicant must apply by letter, giving full particulars of his case, to the Secretary of the Faculty of Applied Science and Engineering not later than September 1, 1948. This application must be accompanied by a letter of recommendation from the principal of the secondary school where his standing was obtained, and if possible a second letter of recommendation from a graduate in engineering, preferably of the University of Toronto, who resides or practises in the vicinity. Application for admission to the University, accompanied by matriculation certificates, must also be submitted to the Registrar of the University at the same time that application for the Bursary is submitted to the Secretary of the Faculty. Some members of the engineering profession have agreed to act as counsellors to prospective students, and the name of one or more of these men residing in the neighbourhood of the applicant may be obtained on application to the Secretary of the Faculty.

THE EMERSON WICKETT MEMORIAL SCHOLARSHIP

The Emerson Wickett Memorial Scholarship, the gift of Mrs. Maude Wickett Kilbourn, in memory of her brother, the late William Emerson Wickett, a graduate of the Faculty of Applied Science and Engineering in 1906, of the value of $100, is awarded to the candidate who, at one examination, obtains standing with the highest average percentage in the subjects of Grade XIII prescribed for admission to the Faculty. An award will not be made in any year in which no candidate obtains an average of at least seventy-five per cent. Application should be made to the Registrar of the University.

THE REGINALD AND GALER HAGARTY SCHOLARSHIP

The Reginald and Galer Hagarty Scholarship, in memory of the dearly beloved sons of Lieutenant-Colonel E. W. Hagarty, B.A. 1883, M.A. 1908, and Charlotte Ellen Hagarty, his wife. Reginald Edward Walter Hagarty, B.A.Sc. (Honours) 1908, a graduate of the University in the Faculty of Applied Science and Engineering and at the time of his death on April 29, 1925, a Consulting Structural Engineer. Lieutenant Daniel Galer Hagarty, Princess Patricia's Canadian Light Infantry, a member of the class of 1916 in Applied Science, enlisted for the Great War at the end of

his third year in June, 1915, killed in action in Sanctuary Wood, June 2, 1916. The scholarship is given in recognition of the fact that their father was an honour graduate in Classics of the University of Toronto. It is of the value of the interest on $2,000 and is to be awarded to a pupil of Harbord Collegiate Institute, Toronto, who at the Grade XIII examinations in the subjects of English, French, Latin and Mathematics stands highest among the students of that school who (*a*) register in the Faculty of Applied Science and Engineering, (*b*) sign a declaration to the effect that they are willing to take up arms in defence of Canada and the British Empire should necessity arise as declared by the Parliament of Canada and (*c*) obtain at least a pass mark in each of the said subjects. The scholarship was offered for award for the first time in 1945. Application should be made to the Registrar of the University.

THE U.T.S. ENGINEERING SCHOLARSHIP

The U.T.S. Engineering Scholarship, the gift of R. A. Bryce, Esq., of the value of $250. The scholarship will be awarded by a committee of the Staff of the University of Toronto Schools to a student of the Schools who has completed the requirements for admission to and enrols in the Faculty of Applied Science and Engineering.

THE LEONARD FOUNDATION SCHOLARSHIPS

Leonard Foundation Scholarships are awarded each year to selected students in Universities and Colleges across Canada, including the University of Toronto. The Trust Deed States: "Preference in the selection of students for scholarships shall be given to the sons and daughters respectively of the following classes: (*a*) clergymen, (*b*) school teachers, (*c*) officers, non-commissioned officers and men, whether active or retired, who have served in His Majesty's military, naval or air forces, (*d*) graduates of the Royal Military College of Canada, (*e*) members of the Engineering Institute of Canada, (*f*) members of the Mining and Metallurgical Institute of Canada."

All applicants must be nominated by a member of the General Committee. The latest date for the receiving of applications is March 31st, for the following academic year. Further information regarding the procedure to be followed in applying for these scholarships may be obtained by writing to Dr. W. E. Taylor, Honorary Secretary, The Leonard Foundation, c/o Toronto General Trusts Corporation, 253 Bay Street, Toronto.

THE ROBERT SIMPSON COMPANY LIMITED SCHOLARSHIPS

These scholarships, the gift of the Robert Simpson Company Limited, are open only to students of the Copper Cliff High School, The Sudbury High and Technical Schools, the Sturgeon Falls High School, the North Bay Collegiate Institute and Vocational School and all the Secondary Schools along the Ontario Northland Railway. A scholarship of the value of $100 is available for each of the schools mentioned and an additional sum of $50 will be given to the student who obtains

the highest percentage on the nine papers of Grade XIII selected in accordance with the regulations.

No scholarship will be awarded unless the candidate is in actual attendance in one of the colleges or faculties of the University and maintains a uniformly high standard to the satisfaction of the donors of the scholarships.

Applications for these scholarships must be sent not later than May 15th, to the Principal of the North Bay Collegiate Institute, from whom further information may be obtained regarding the conditions of award.

THE ONTARIO HOCKEY ASSOCIATION WAR MEMORIAL SCHOLARSHIP

The Ontario Hockey Association War Memorial Scholarship, the gift of the Ontario Hockey Association, is to be awarded annually at the Grade XIII examination to a man student who has served overseas with the Canadian forces in the Great War of 1914-1918, or to a student who is the son or daughter of one who has so served.

The value of this scholarship is $100 in cash, with an allowance of the same amount on the tuition fee for each session.

In determining the award of the scholarship, the academic qualifications of the candidates shall be first taken into account, provided always that no candidate shall be eligible for an award who has not met all the conditions required by the University of candidates for admission scholarships generally; but, *cæteris paribus*, the award shall be made to a student who is in proved need of assistance.

The award shall be made by the Senate of the University upon the report of a committee to be appointed by the Senate, upon which committee there shall be always one member of the Staff of the University who shall be deemed to be the representative of the Association.

Candidates shall make application not later than May 1st on the special form to be obtained from the Registrar of the University.

ENGINEERING ALUMNI ADMISSION SCHOLARSHIP

The Engineering Alumni Admission Scholarship, the gift of the Engineering Alumni Association, of the value of $300, is awarded on the recommendation of the Council of the Faculty to the candidate who obtains the highest average percentage in the subjects of Grade XIII prescribed for admission to the Faculty of Applied Science and Engineering; applicants are required to write the Problems paper for Scholarship candidates, but the standing on this paper will be used only as auxiliary information. In order to qualify for the scholarship a candidate must at one Scholarship examination obtain an average of at least seventy-five per cent. in the subjects of Grade XIII prescribed for admission to the Faculty and must register in the Faculty of Applied Science and Engineering. The scholarship will not be awarded to a student who has spent more than one year in Grade XIII or more than five years in a Secondary School

or its equivalent unless he can show evidence satisfactory to the Council that his attendance has been extended beyond the period specified for reasons beyond his control. This scholarship is not tenable with any other Admission scholarship.

STUDENTS' ADMINISTRATIVE COUNCIL ADMISSION SCHOLARSHIP

The Students' Administrative Council Admission Scholarship of the annual value of $300, the gift to a student who (*a*) resides within the District of Manitoulin, or within that part of the Province of Ontario which lies north of the forty-sixth parallel of latitude excluding the cities of North Bay, Sudbury, Sault Ste. Marie, Port Arthur and Fort William; (*b*) obtains the highest average standing in first class honours in the nine papers of Grade XIII prescribed for admission to the course which he desires to enter: and (*c*) who enrols in one of the following faculties: Medicine, Applied Science and Engineering, Forestry, Dentistry, or in the Four-Year Course leading to the degree of Bachelor of Science in Pharmacy.

The scholarship is tenable for two years provided that the holder obtains an average of at least sixty-six per cent, at the annual examinations of the First Year. Application must be made to the University Registrar not later than May 1st.

ONTARIO-MINNESOTA PULP AND PAPER COMPANY LIMITED BURSARIES

The Ontario-Minnesota Pulp and Paper Company Limited Bursaries, awarded at the discretion of the donors, two in number, each of the value of $500 a year for four years for students who enrol in the Faculty of Arts in the honour courses of Chemistry, Physics and Chemistry (Chemistry option) or Commerce and Finance, or in the Faculties of Applied Science and Engineering or Forestry. They will be awarded one to a student who has completed the University admission requirements at Kenora High School after at least two years' attendance at that school, and the other to a student who has completed the University admission requirements at Fort Frances High School after at least two years' attendance at that school. The decision of the Committee of Award which consists of the President and the Deans of the Faculties of Arts, Applied Science and Engineering, and Forestry will be based primarily on the marks obtained at the Grade XIII examination, but consideration will be given also to physical fitness and financial requirements. In order to retain a bursary from session to session the student to whom one is awarded must, in the opinion of the Committee of Award have a satisfactory record as regards the general character of his work throughout the session, including attendance, laboratory and field work, if any, reports or essays, and term examinations, and must obtain standing in his year. His behaviour while attending the University must be above criticism. Application must be made to the Registrar not later than May 1st.

ALGOMA ORE PROPERTIES LIMITED ADMISSION SCHOLARSHIPS

Algoma Ore Properties Limited, Sault Ste. Marie, Ontario, provided funds for one Admission Scholarship for the Session 1947-48, and five Admission Scholarships for the Session 1948-49, each of a value of $800.00. They were open only to students entering Mining Engineering, Metallurgical Engineering, and Mining Geology, and awarded to applicants obtaining the highest average percentage in the subjects of Grade XIII prescribed for admission to the Faculty of Applied Science and Engineering.

Provision is made for the winner of the Scholarship in 1947 to hold a Scholarship in his Second Year, and succeeding years of a value of $600.00 annually, provided he obtains Honours each year. Provision is also made for scholarships in the Second Year and succeeding years of a value of $600.00 each, to be awarded to the two students who obtain the highest honour standing, of the five who are awarded the admission scholarships in 1948

ALUMNI FEDERATION WAR MEMORIAL SCHOLARSHIPS AND AWARDS

Eight scholarships and awards, each of the value of $200.00 will be granted in 1948-49 by the Alumni Federation from the War Memorial Scholarship Fund to students registered in the Faculty of Applied Science and Engineering.

The general basis on which scholarships or awards may be granted shall be as follows: (*a*) standing in course of studies; (*b*) relationship to active service in the armed forces of Canada; (*c*) need of financial assistance; (*d*) merit shown by participation and interest in extra-curricular undergraduate activities of the University; (*e*) such other general qualifications as may commend themselves to the committee recommending the awards.

Information regarding these scholarships and awards may be obtained from the Secretary of the Alumni Federation, 42 St. George Street, to whom application for the same must be made in person before April 15th.

BAPTIE SCHOLARSHIP

The Baptie Scholarship is derived from a bequest under the will of the late Mrs. Margaret W. Baptie, of Ottawa, and the Board of Governors has directed that from the income a scholarship of One Hundred Dollars shall be awarded annually to an engineering student on the record of the First Year. The Board of Governors also authorizes a remission of fees in the case of the holder of the scholarship, up to Seventy-five Dollars.

The conditions of the award are as follows: That the scholarship be awarded to the student who, in the annual examinations of the First Year, enrolled in any one of the courses of Civil Engineering, Mining Engineering, Mechanical Engineering, Chemical Engineering, Electrical Engineering, or Metallurgical Engineering, obtains the highest aggregate percentage of marks in those subjects which are common to the First Year curricula of those courses. The first award was made on the results of the annual examinations of the Session 1925-26.

MACLENNAN-MACLEOD MEMORIAL PRIZE

The Graduating Class of 1910 has donated an annual prize to the value of Twenty-five Dollars, known as "The MacLennan-MacLeod Memorial Prize", in memory of their first Class President, George MacLennan, who was killed in action in France in 1917, and of Doug. MacLeod, their first Secretary, who died in France in 1916 from wounds received in action.

The prize is awarded to the First Year student in the Faculty of Applied Science and Engineering who ranks highest in Calculus among those who obtain standing without condition at the annual written examinations; or, in the event of more than one student obtaining equally high rank in Calculus, the award is made to the one of these who also has the highest standing in some other subject common to the competitors, such as Analytical Geometry, such subject to be determined by the Council of the Faculty.

An award will not be made in any year in which, in the opinion of the Council, no student obtains a sufficiently high standing in Calculus to merit the award. In any year in which no award is made, the income from the prize of that year will be available for a second award in any subsequent year.

RANSOM SCHOLARSHIP IN CHEMICAL ENGINEERING

The Ransom Scholarship in Chemical Engineering is presented by A. C. Ransom, Esq., of Toronto, for the purpose of encouraging and giving financial assistance to students who choose the field of Chemical Engineering. This donation, consisting of $5,000, provides for a perpetual scholarship of an annual amount such as will be derived from the income of this sum. The first award was made on the results of the annual examinations of 1938.

The scholarship will be awarded annually to the student registered in the Course in Chemical Engineering who obtains the highest aggregate percentage of marks in the examinations of the First Year. The scholarship will be paid to the winner only if he proceeds to take his Second Year in the Course in Chemical Engineering in the University of Toronto.

THE T. H. BICKLE PRIZE

The T. H. Bickle Prize is the gift of Mr. and Mrs. E. W. Bickle in memory of their son, T. H. Bickle, an undergraduate of Trinity College and a member of the Senior Intercollegiate Swimming Team at the time of his death in 1937. The income from the endowment fund will be used to purchase a suitable prize to be awarded annually to a member of the Senior Intercollegiate Swimming Team of this University in any year, faculty or school. The Committee of Award shall consist of the Dean of the Faculty of Arts, the University Registrar, the Director of Athletics, and the Honorary Coach of Swimming. In awarding the Prize the Committee shall consider the character, scholarship, and general interests of the members of the team.

THE JOHN M. EMPEY SCHOLARSHIPS

The John M. Empey Scholarship Fund was established under a bequest of $10,000 in the Will of the late John Morgan Empey, B.A.Sc., 1903. Three scholarships of equal value are provided from the income from the Fund. One of these scholarships is awarded in each of the First, Second, and Third Years on the results of the annual examinations, to a student who, taking honours, obtains the highest average percentage of marks in the written and laboratory subjects of his Year. The scholarships are open to any students registered in the Faculty. In case the winner of any one of these scholarships does not attend this Faculty during the session next following the award, the right to the scholarship shall be forfeited and the award shall be made to another eligible student. The scholarships were awarded for the first time in 1944.

THE GARNET W. MCKEE-LACHLAN GILCHRIST SCHOLARSHIP IN ENGINEERING PHYSICS

Mrs. Garnet W. McKee and Professor Lachlan Gilchrist each contributed $1000.00 to provide for a Scholarship in the First Year of the Course in Engineering Physics. The value of the Scholarship is the annual income from the capital fund and is awarded to the student who ranks first in honours at the annual examinations of the First Year in the Course in Engineering Physics. If for any reason that student is ineligible to hold the Scholarship, it will be awarded by reversion to the student ranking second in honours in the Course. In order to receive payment the winner must register in the Second Year of the Course in Engineering Physics. The Scholarship was awarded for the first time on the results of the annual examinations of 1947.

WALLBERG UNDERGRADUATE SCHOLARSHIPS

These scholarships, four in number, of the value of $300.00 each, derived from the Wallberg Bequest, are awarded annually; two to students ranking first and second respectively at the annual examinations of the First Year; one to the student ranking first at the annual examinations of the Second Year; and one to the student ranking first at the annual examinations of the Third Year.

Any holder of one of these scholarships may not hold other awards isted in the Calendar with an asterisk. The awards were first made on the results of the annual examinations of 1947.

HUGH GALL AWARD

The Hugh Gall Award, of the value of One Hundred Dollars, the gift of the Graduate Class of 1910, "to commemorate a deceased classmate who was a splendid type of student, a loyal friend, and nationally outstanding in athletic achievement during his undergraduate career", was established in 1946. It is awarded to a student, who, having completed his First Year with a general average of at least 66% without conditions,

has entered the Second Year, and is in special need of financial assistance in order to enable him to continue his course. It is desirable, but not necessary, that the recipient shall not already have been given any other scholastic award or scholarship applicable to the Second Year and he shall have shown indications of his firm intention and ability to follow successfully the profession of engineering.

Any second year student in the Faculty of Applied Science and Engineering is eligible to apply for this Bursary. Applications should be made to the Secretary of the Faculty not later than one month after the opening of the session.

CARL SWAN AWARD

The Carl Swan Award, the gift of the Reverend Carl Swan, Chaplain of the Ajax Division, of the value of $80.00, is awarded annually to the First Year student of the Ajax Division, who is adjudged to have made the most outstanding and the most consistent contribution to the life of the campus in the social, athletic and cultural fields, and whose academic standing commends itself to the Selection Committee.

The first award was made for the Session 1946-47.

UNIVERSITY NAVAL TRAINING DIVISION BURSARIES

The University Naval Training Division Bursaries, the gift of the University Naval Training Division, are of the value of $100. each. As many as three bursaries may be awarded in each session; if fewer than three are awarded those not awarded may be given in a subsequent session, A candidate must be registered in the University for a full-time course leading to a diploma or degree and must be at the time of the award a member of one of the recognized military training units within the University. Application must be made to the University Registrar before the end of November.

ALGOMA ORE PROPERTIES LIMITED UNDERGRADUATE SCHOLARSHIPS

Through the generosity of Algoma Ore Properties Limited, Sault Ste. Marie, Ontario, a number of Scholarships are available to students in Mining Engineering, Metallurgical Engineering, and Mining Geology, each of a value of $600.00. On the results of the annual examinations for the Sessions indicated below, the following scholarships will be awarded:

Session 1947-48

I Year—One Scholarship of Six Hundred Dollars.
II Year—Three Scholarships of Six Hundred Dollars.
III Year—Three Scholarships of Six Hundred Dollars.

Session 1948-49

I Year—Two Scholarships of Six Hundred Dollars.
II Year—One Scholarship of Six Hundred Dollars.
III Year—Three Scholarships of Six Hundred Dollars.

Session 1949-50

II Year—Two Scholarships of Six Hundred Dollars.

III Year—One Scholarship of Six Hundred Dollars.

Session 1950-51

III Year—Two Scholarships of Six Hundred Dollars.

On the examination results of 1947-48 the First Year Scholarship will be awarded to the winner of the Algoma Ore Properties Limited Admission Scholarship of September, 1947, provided he obtains Honours. The Second and Third Year Scholarships will be awarded to those obtaining highest Honour standing in Mining Engineering, Metallurgical Engineering, and Mining Geology. It is the intention that a student having once won a scholarship on the results of the Annual Examinations should continue to hold it, provided he obtains Honours in his work in subsequent years.

On the examination results for First Year for 1948-49, scholarships will be awarded to the two students who stand highest of the five who are awarded Algoma Ore Properties Admission Scholarships in September, 1948.

The holders of any of these scholarships may not hold other scholarships in the same session.

S. UBUKATA FUND

The S. Ubukata Fund for Japanese Students, the gift of the late S. Ubukata, provides for the establishment of scholarships, bursaries, medals, prizes, and loans for students from Japan proper attending the University of Toronto or one of its federated or affiliated colleges. An applicant for a scholarship, bursary or loan must be in good standing and have completed the first year of the work of the faculty or department in which he is registered. An occasional student must obtain a certificate from the head of the college or dean of the faculty concerned that full time is being devoted to his or her studies. A student is not eligible who is at the time in receipt of aid or support from any other institution, religious or otherwise, in this country or in Japan or who already holds a scholarship or fellowship in the University. Application must be made to the University Registrar on or before December 1st.

HARVEY AGGETT MEMORIAL SCHOLARSHIP

This scholarship was donated by the late Mr. J. T. Aggett, of Toronto, as a perpetual memorial to his son, the late Lieutenant Harvey Aggett, who enlisted in March, 1915, during his second year in this Faculty, and was killed in action at Passchendaele on 6th November, 1917.

This annual scholarship of the value of the annual income from the fund is to be awarded to a student of the Second Year in this Faculty who, obtaining honours and being one of the first three in his year by his standing at the annual examinations, has been adjudged highest of the three in general student activities and service in the University during his period of attendance. When regulations do not permit the winner to hold this

scholarship the students to be considered for the award shall be the first three in the year exclusive of any student who holds a scholarship of higher value.

ONTARIO ASSOCIATION OF ARCHITECTS SCHOLARSHIP

The Ontario Association of Architects offers a scholarship of One Hundred Dollars to the student of the Second Year in the School of Architecture who, at the annual examinations, obtains the highest honour standing in Architectural Design. The scholarship was awarded annually from 1928 to 1945 inclusive and has been extended for a further period of five years.

J. A. FINDLAY SCHOLARSHIPS

These scholarships were established through a legacy bequeathed by the late Miss Janet Findlay to the Department of Mechanical Engineering. Two scholarships are available to students in this Course, one for a student in the Third Year, the other for a student in the Fourth Year, but only if the student continues his course in Mechanical Engineering. The selection will be made, on recommendation of the Head of the Department of Mechanical Engineering, from amongst the four students having the highest average percentage of marks at the annual examinations in the Second and Third Years respectively, but in making the award the student's general character, fitness for his profession, and financial circumstances will be given consideration. In case a student who has been awarded one of the scholarships changes his course or does not attend this University during the next following session, he shall forfeit his right to the scholarship and the award shall be made to another eligible student.

ASSOCIATION OF PROFESSIONAL ENGINEERS OF THE PROVINCE OF ONTARIO SCHOLARSHIPS

The Association of Professional Engineers of the Province of Ontario offers the following scholarships to students registered in any course of the Faculty of Applied Science and Engineering (except Architecture):—

(*a*) Scholarships of One Hundred Dollars, Seventy-five Dollars and Fifty Dollars, respectively, to the three students in the First Year who, taking honours, obtain the highest percent of the total number of marks in their respective courses.

(*b*) Scholarships of One Hundred Dollars and Seventy-five Dollars, respectively, to the two students in the Second Year who, taking honours, obtain the highest per cent of the total number of marks allotted to the subjects of their respective courses.

(*c*) Scholarships of One Hundred Dollars, Seventy-five Dollars and Fifty Dollars, respectively, to the three students in the Third Year who, taking honours, obtain the highest per cent of the total number of marks in their respective courses.

These scholarships will not be awarded to students who hold other scholarships.

THE WOMEN'S MINING ASSOCIATION BURSARY

The Women's Mining Association has presented a Bursary having the value of Three Hundred Dollars annually, commencing 1939. The Bursary is awarded to a student entering the Third or Fourth Year in the Course in Mining Engineering, Metallurgical Engineering, or Mining Geology; it may be awarded two years in succession to the same student, but will usually be awarded at the beginning of the Third Year. The award will be made by a special committee appointed by the Association on the following basis:

(*a*) In addition to mental capacity, the student must show leadership ability and give promise, through his activities, of becoming a worthwhile influence in the affairs of the profession and the community.

(*b*) While attention is given to scholastic ability, as evidenced by his academic standing, it is not the governing factor. He must, however, stand in the top quarter of his class.

(*c*) Special consideration is given to financial need.

Application must be made to the Secretary of the Faculty within one month of the opening of the academic year.

THE GARNET W. MCKEE-LACHLAN GILCHRIST GEOPHYSICS SCHOLARSHIPS

Financial assistance was received by Professor Lachlan Gilchrist of the Departments of Physics, University of Toronto, from certain organizations and individuals to help him in the prosecution of his research work in Geophysics. With the consent of the contributors, the unexpended balance of these gifts was transferred by Professor Gilchrist to the Board of Governors of the University to be used as an endowment for scholarships, two of which were established in the Faculty of Applied Science and Engineering. To this fund have been added additional amounts received from the estate of the late Garnet W. McKee and from the Hollinger Consolidated Gold Mines Ltd. They are awarded by the Senate, on the recommendation of the Council of the Faculty of Applied Science and Engineering. The first awards were made on the results of the Annual Examinations of 1941.

The First Garnet W. McKee-Lachlan Gilchrist Geophysics Scholarship. This scholarship, of the annual value of the income from $4,000.00, is awarded to the student in the Second Year in the Course in Engineering Physics who obtains the highest aggregate standing at the examinations of the First and Second Years in the Course, provided always that the student obtains honour standing at the examinations of the Second Year.

The Second Garnet W. McKee-Lachlan Gilchrist Geophysics Scholarship. This scholarship, of the annual value of the income from $3,000.00, is awarded to the student in the Second Year in the Course in Engineering Physics who, of those students who elect to proceed in the Third Year in the Geophysics Option of the Course, obtains the highest aggregate stand-

ing at the examinations of the First and Second Years, provided always that the student obtains honour standing at the examinations of the Second Year, and excluding always the student to whom the First Lachlan Gilchrist Geophysics Scholarship has been awarded.

If in any year there is no student who has fulfilled the conditions as laid down for the Second Lachlan Gilchrist Geophysics Scholarship, it shall be awarded to the student in the Second Year in the Course in Engineering Physics who obtains the second highest aggregate standing at the examinations of the First and Second Years of that Course, provided always that such student obtains honour standing in the examinations of the Second Year.

THE W. G. MILLAR MEMORIAL SCHOLARSHIP

The W. G. Millar Memorial Scholarship is presented by Irish and Maulson, Limited, of an annual value of $250.00, in memory of the late Mr. W. G. Millar, a member of the Class of 1914 in Civil Engineering. The Scholarship will be awarded to a student entering the Third Year in Mining Engineering, on the recommendation of the Head of the Department of Mining Engineering.

The award will be made on the following basis:

(a) In addition to mental capacity, the student must show leadership ability and give promise, through his activities, of becoming a worthwhile influence in the affairs of the profession and the community.

(b) While attention is given to scholastic ability, as evidenced by his acedamic standing, it is not the governing factor. He must, however, stand in the top quarter of his class.

(c) Special consideration is given to financial need.

Application must be made to the Secretary of the Faculty within one month of the opening of the academic year.

ARDAGH PRIZE

The Ardagh Prize, of the annual value of Fifty Dollars, has been provided in memory of his parents by Professor E. G. R. Ardagh, B.A.Sc., F.R.S.C., formerly professor of Applied Chemistry in the Faculty. It is awarded to the student who attains the highest standing in Honours at the annual examinations of the Second Year in the Course in Chemical Engineering. The first award was made on the results of the annual examinations of 1946.

Provision has been made for annual increases to the fund from which the prize is derived until the sum of Five Thousand Dollars is reached in 1956, at which time the award becomes the Ardagh Scholarship of the value of the income from the said fund.

JAMES L. MORRIS MEMORIAL PRIZE

The James L. Morris Memorial Prize is the gift of Mrs. J. H. Craig and Mr. J. R. Morris, K.C., in memory of their father, James L. Morris,

C.E., O.L.S., D.Eng., the first graduate of the School of Practical Science, who died in 1946 after a distinguished career. Graduating in Civil Engineering in 1881 as the sole member of his class, Dr. Morris engaged in railway work for some time, first as an engineer and then as a contractor. For 43 years he conducted a successful civil engineering practice in Pembroke, Ontario, involving important undertakings in the field of municipal, power and bridge work.

This Prize, of the value of the annual income from $2,000.00, is awarded annually to the student in the Second Year in the Course in Civil Engineering who obtains the highest aggregate percentage at the annual examinations of the First and Second Years of the course, provided always that the student obtains honour standing at the examinations of the Second Year.

EASTERN STEEL PRODUCTS LIMITED SCHOLARSHIP

The Eastern Steel Products Limited Scholarship of an annual value of $350.00 has been established in the course in Mechanical Engineering for a period of five years.

The Scholarship will be awarded to a student entering the Third Year in Mechanical Engineering who:

(*a*) was registered in the course in Mechanical Engineering in this Faculty in his First and Second Years.

(*b*) obtained Honours in the work of the First and also of the Second Year.

(*c*) gives evidence not only of mental capacity but who also shows leadership ability, and gives promise of becoming a worth while influence in affairs of the profession and the community.

Consideration is given to financial need.

Application must be made to the Secretary of the Faculty not later than March 15.

The first award was made at the Annual Examinations of 1948.

BOILER INSPECTION AND INSURANCE COMPANY SCHOLARSHIP

The Boiler Inspection and Insurance Company of Canada offers a scholarship in the Course in Mechanical Engineering of the value of One Hundred and Fifty Dollars to the student who obtains highest honour standing in the regular examinations of the Third Year.

The successful candidate will be expected to proceed to his Fourth Year during the session next following the date of the award.

The amount of the award will be credited by the Bursar to the fees of the Fourth Year of the successful candidate.

JENKINS SCHOLARSHIP

The Jenkins Scholarship, presented by Jenkins Bros., Limited, Montreal, first awarded in 1925, has been donated to continue indefinitely.

This Annual Scholarship, of the value of Two Hundred Dollars, is awarded to the student of the Third Year registered in any course of the Faculty who has the highest aggregate of percentages for the First, Second, and Third Years.

HEATING AND VENTILATING ENGINEERS PRIZE

The Ontario Chapter of the American Society of Heating and Ventilating Engineers offers an annual prize of Twenty-five Dollars, first awarded in 1931, for a period of five years, and extended indefinitely in 1935. The prize will be awarded to a student in either the Third or Fourth Year in any Course of the Faculty who, in the opinion of the Department of Mechanical Engineering, has written the most satisfactory thesis on a subject dealing with heating or ventilation, such thesis being prepared under special arrangements made by the Department of Mechanical Engineering, the result to be reported to the Council with the annual examination results. The thesis must be handed in not later than March 1st. The prize will not necessarily be awarded in any year.

Application should be made to the Department of Mechanical Engineering.

ENGINEERING INSTITUTE OF CANADA PRIZE

The Engineering Institute of Canada, having in view that one of its objects is to facilitate the acquirement and interchange of professional knowledge among its members, offers an annual prize of Twenty-five Dollars in this University, commencing 1931, to the student who, in his Third Year in any one of the six courses of Engineering, has proved himself most deserving as disclosed by the examination results of the year, in combination with his activities in the Engineering Society or with a local branch of another recognized engineering organization.

ENGINEERING SOCIETY SEMI-CENTENNIAL AWARD

The Engineering Society Semi-Centennial Award, to the value of Seventy-five Dollars, was established in 1931 to commemorate the semi-centennial of the founding of the "School". The award is made to a student entering the final year.

The selection is based upon the following qualifications, which bear equal weight in the selection of the winner: (*a*) General "School" activities. (*b*) Contributions to the Engineering Society Executive Committee. (*c*) Personality, and social and athletic activities. (*d*) Academic standing.

ARCHIE B. CREALOCK MEMORIAL PRIZE

The Archie B. Crealock Memorial Prize is the gift of Mrs. Archie B. Crealock, in memory of her husband, an eminent bridge engineer and a graduate of the Faculty of Applied Science and Engineering of the University of Toronto. It is offered annually to the student of the Third Year in the Course in Civil Engineering, who, having obtained honours in

that year, is deemed to be the most worthy of the award. The award is made primarily on the basis of academic standing in the structural subjects of the Year, but extra-curricular activities are also taken into consideration. The Prize consists of engineering books to the value of Twenty-five Dollars. The award will not necessarily be made in any year.

HUDSON BAY MINING AND SMELTING COMPANY LIMITED SCHOLARSHIPS

The Hudson Bay Mining and Smelting Company Limited awards Scholarships to students who have obtained their Senior Matriculation at the High Schools in Flin Flon, Manitoba, and its environs. These Scholarships, having a value of $800.00 each annually, may be held in the Third and Fourth Years in this Faculty, in the Courses in Chemical Engineering, Metallurgical Engineering, Mining Engineering, and Mining Geology. Application should be made to the Company.

TORONTO BRICK COMPANY PRIZES

The Toronto Brick Company offers two prizes, one of Seventy-five Dollars and one of Twenty-five Dollars, to those students of the Third Year in the School of Architecture who win first and second places in a competition arranged by the Staff in the School of Architecture for this purpose.

THE CHEMICAL INSTITUTE OF CANADA PRIZE

The Chemical Institute of Canada offers a prize of the annual value of $25.00 in books to the student registered in the course in Chemical Engineering who, having obtained honours, receives the highest standing in the written and laboratory work of the Third Year.

The first award was made on the results of the final examinations of 1947.

B.A.A.S. MEDAL

A bronze medal has been donated by members of the British Association for the Advancement of Science, for students of the Faculty of Applied Science and Engineering. This medal will be awarded to the student of the Final Year, in any course, who, taking honours, obtains the highest aggregate percentage in practical and written examinations in the Year.

INCO SCHOLARSHIP

The International Nickel Company of Canada, Limited, offers a scholarship of $500.00, commencing with the Session 1941-42, and from year to year thereafter as the Company may decide, to be awarded to a graduate of the Faculty of Applied Science and Engineering in Chemical Engineering, Metallurgical Engineering, Mining Engineering or Mining Geology, who has taken a consistently high standing in the majority of the subjects of his course, and who is adjudged by the Council of the Faculty to be most suitable to receive the award.

The applicant must proceed to the M.A.Sc. degree in the Session in which he receives the scholarship. Application must be made before May 1, to the Secretary of the School of Graduate Studies, with a statement of the research problem which he proposes to study.

HOBBS GLASS, LIMITED, SCHOLARSHIP

Hobbs Glass, Limited, offers a scholarship annually, commencing with the Session 1945-46, to the student of the Fourth Year in Architecture presenting the best solution to a problem of design set by the staff in Architecture in consultation with the donor. The value of the scholarship is the Fifth Year academic fee.

"SECOND MILE ENGINEER" AWARD

Inspired by an address of President William E. Wickenden of Case School of Applied Science, Cleveland, called "The Second Mile", which was based on the text from the Sermon on the Mount, "whosoever shall compel thee to go one mile, go with him twain", the Class of 1935 has established the "Second Mile Engineer" Award. It is the desire of the donors to encourage students to participate in activities outside the confines of their technical training and to interest themselves in the more liberal subjects of the curriculum. The value of the award is $100.00 and is given to a student in his final year.

An eligible group is chosen from those who have taken a prominent part in the affairs of the Faculty, either as office holders or in athletics. In making the award consideration is given to academic standing, with special emphasis on the candidate's attainments in the cultural and humanistic-social studies. The subjects which are stressed are English, and Engineering and Society of the First Year; Economics of the Second Year; and Political Science, and Modern World History of the Third Year.

Particulars are furnished each session by the Class of 1935.

HENRY G. ACRES MEDAL

The Henry G. Acres Medal is the gift of Mrs. Henry G. Acres in memory of her late husband, Henry G. Acres, M.E., D.Sc., a graduate of the School of Practical Science in the class of 1903. Throughout his professional life Dr. Acres was associated with major power developments in Canada and abroad. As chief hydraulic engineer for the Hydro-Electric Power Commission of Ontario in the period 1911 to 1923, he was responsible for the design and construction of nearly twenty power plants, including the Queenston-Chippawa development. Entering private practice in 1924, and until his death in 1945, he continued to widen and extend his interests. He became chief engineer of the Grand River Conservation Commission and responsible for the design and construction of the Shand dam and related work. Later, he was consulting engineer for the extensive power development at Shipshaw on the Saguenay River,

which was vital to the production of aluminum for war purposes. Many of the provinces of Canada sought his services and he advised with respect to work in Newfoundland, South America and India.

This medal is awarded annually to the student in the Fourth Year who is registered in the course in Civil, Mechanical, or Electrical Engineering, and who obtains the highest aggregate percentage at the annual examinations of the Third and Fourth Years, provided always that the student obtains honour standing in the examinations of the Fourth Year. Receipt of the medal does not preclude a student from being granted such other award as may in the opinion of the Council be appropriate.

ANACONDA AMERICAN BRASS LIMITED PRIZES

Anaconda American Brass Limited offers prizes in the School of Architecture for the Session 1947-48, a first prize of $200.00 and a second prize of $100.00 to the two students of the Fifth Year in Architecture, who obtaining honour marks, stand first and second, respectively, in the best solution of a problem in design set by the staff of the School of Architecture in consultation with the Company.

TORONTO ARCHITECTURAL GUILD MEDAL

The Toronto Architectural Guild was the organization of local architects from which sprung the Ontario Association of Architects. When the new and wider association became firmly established, the Guild disbanded and handed over to a trustee board certain funds for the establishment of a medal to be awarded in the School of Architecture of the University of Toronto.

The Trustee Board, now that the fund has accumulated considerably, announces its intention of awarding this medal annually to a senior student showing outstanding ability in Architectural Design.

ROYAL ARCHITECTURAL INSTITUTE OF CANADA MEDAL

The Royal Architectural Institute of Canada has presented a medal to be awarded annually to a member of the graduating class in the School of Architecture who, having completed the requirements for the degree, has obtained high standing throughout his course and gives promise of being an architect of distinction after graduation. The person to whom the award is made must be a British subject; he must have completed the entire course in Architecture in the School of Architecture of the University of Toronto, except in the case of a graduate of the Royal Military College who shall have completed at least the third, Fourth, and Fifth Years in the School; he must have obtained high standing throughout his course, particularly in Architectural Design, and his character, personality, and intellect must be such as to indicate that in the practice of his profession, he may be expected to attain distinction. No award will be made in any Session in which the Council of the Faculty of Applied Science and Engineering so recommends.

THE RHODES SCHOLARSHIP

The Rhodes Trustees offer two scholarships for award annually in the Province of Ontario, each of the basic value of £400 a year but temporarily increased to £500. They are tenable ordinarily for two years at the University of Oxford. A third year is given conditionally at Oxford or elsewhere abroad.

Each candidate must be a British subject with at least five years domicile in Canada, and unmarried; he must have passed his nineteenth but not his twenty-fifth birthday on October 1st of the year for which he is elected; he must have completed the first year and have entered upon the second year of his course at a Canadian university at the time of application.

"Service" candidates who have had at least one year of war service, are not disqualified by marriage, and may deduct the war years to bring themselves within the age limits.

In that section of the will in which he defined the general type of scholar he desired, Mr. Rhodes mentioned four groups of qualities, the first two of which he considered most important:

(1) Literary and scholastic attainments;

(2) Qualities of manhood, truth, courage, devotion to duty, sympathy, kindliness, unselfishness, and fellowship;

(3) Exhibition of moral force of character and of instincts to lead and to take an interest in his fellows;

(4) Physical vigour, as shown by fondness for and success in outdoor sports.

Some definite quality of distinction, whether in intellect, character or personality, or in any combination of these, is the most important requirement. Financial need does not receive special consideration.

Forms of application and full information regarding these scholarships may be obtained from the Hon. D. R. Michener, 5 Rosedale Road, Toronto 5, General Secretary for Canada or from A. B. Harvey, Esq., K.C., c/o Law Society of Upper Canada, Osgoode Hall, secretary of the Ontario Selection Committee, or from the University Registrar. Selection is made in December each year for the scholarships for the year following. Application must be made to Mr. Harvey on or before November 1st.

THE 1851 EXHIBITION SCIENCE RESEARCH SCHOLARSHIPS

The Royal Commissioners for the Exhibition of 1851 have invited the University of Toronto to recommend annually one or more candidates in order of merit for science research scholarships, each of the value of £350 per annum and ordinarily tenable for two years. The Commissioners may make a supplementary grant up to £50 per annum for University fees, etc., payable by the scholar during his tenure of the award.

Each candidate recommended must be a British subject, and under twenty-six years of age except in very special circumstances; he must have

been a student of science in a university institution for a period of not less than three years and must have spent one full academic year at this University ending not more than twelve months prior to the date of recommendation.

The record of a candidate's work must indicate high promise of capacity for advancing science or its applications by original research. Evidence of this capacity, which is the main qualification for the scholarship, is strictly required. The most suitable evidence is a satisfactory account by the candidate of research work already performed, and the Commissioners will decline to consider the claims of a candidate unless such an account is furnished, or unless there is other equally distinct evidence that he possesses this qualification.

The scholar will be required to devote his whole time to research in some branch of pure or applied science at an institution in the United Kingdom or abroad, selected with the approval of the Commissioners.

The following are the departments of the University, the students of which are eligible to apply for these scholarships: 1. Bacteriology; 2. Biochemistry; 3. Botany; 4. Chemistry; 5. Engineering; (chemical); 6. Engineering (civil); 7. Engineering (electrical); 8. Engineering (mechanical); 9. Engineering (metallurgical); 10. Engineering (mining); 11. Forestry; 12. Geological Sciences; 13. Physics; 14. Physiology; 15. Zoology.

A Student shall not be deemed to be eligible because of his being on the staff of the university, if he has not been in receipt of a salary of more than $800 per annum and the nominating board may, at its discretion, recommend candidates who have been in receipt of larger salaries provided that all other conditions are fulfilled.

A student shall be deemed to be eligible in the year in which he intends to graduate, but if nominated for the scholarship his nomination shall be subject to his being successful in passing his examination for his degree.

The nominating board consists of the following members appointed by the Senate:—the Chancellor, the President, the Provost of Trinity College, Dean Beatty, Dean Innis, Assistant Dean Ryerson, Dean Young, Dr. C. S. MacInnes and Mr. N. F. Parkinson, and the Board shall have power to call to its aid as assessor any member of the teaching staff.

Applications for these scholarships must be submitted not later than April 15th to the University Registrar from whom copies may be obtained of the general regulations of the Commissioners governing the award and tenure of the scholarship.

McCHARLES PRIZE

This prize, the gift of the late Æneas McCharles of the value of $1,000, is awarded from time to time but not necessarily every year on the following terms and conditions: (1) to any Canadian from one end of the country to the other, and whether student or not, who invents or discovers

any new and improved process for the treatment of Canadian ores or minerals of any kind, after such process has been proved to be of special merit on a practical scale; (2) or for any important discovery, invention or device by any Canadian that will lessen the dangers and loss of life in connection with the use of electricity in supplying power and light (3) or for any marked public distinction achieved by any Canadian in scientific research in any useful practical line. The following conditions determine the method of award:—

(1) The title shall be the McCharles Prize.

(2) The value of the prize shall be One Thousand Dollars ($1,000.00) in money.

(3) Every candidate for the prize shall be proposed as such in writing by some duly qualified person. A direct application for a prize shall not be considered.

(4) The composition of the awarding body shall be as follows:—

An expert in Mineralogy,
An expert in Electricity,
An expert in Physics,

and four other persons. All of the members of this body shall be nominated by the Board of Governors of the University of Toronto.

NIPISSING MINING COMPANY RESEARCH FELLOWSHIP

The Nipissing Mining Company has endowed a Research Fellowship in the Department of Mining Engineering, to be known as The Nipissing Mining Company Research Fellowship, of the annual value of the income from the fund, plus free tuition.

This Fellowship is open to graduates of any University.

THE H. W. PRICE RESEARCH FELLOWSHIP IN ELECTRICAL ENGINEERING

The H. W. Price Research Fellowship in Electrical Engineering consisting of the income or a part thereof but not exceeding the income for three years derived from the sum of $10,000 donated by the Hydro Electric Power Commission of Ontario, will be awarded from time to time to a graduate in Electrical Engineering of any recognized University, registered in the School of Graduate Studies, wishing to proceed with an investigation in the field of Electrical Engineering.

Forms of application may be obtained from the Secretary, School of Graduate Studies, and should be returned with a statement of qualifications not later than March 1st. The first award was available in 1943.

THE C.I.L. FELLOWSHIP IN CHEMISTRY

This Fellowship, the gift of Canadian Industries Limited, of the value of $750 is established for the encouragement of post-graduate work in Chemistry. It is open to any British subject who is a graduate of a recognized University. The holder of this Fellowship will be required to

undertake research in any branch of Chemistry under the direction of the department designated by the Committee of Award. Application must be made, with full statement of qualifications and testimonials, to the Secretary of the School of Graduate Studies not later than March 1st.

T. A. RUSSELL MEMORIAL RESEARCH FELLOWSHIP

The T. A. Russell Memorial Research Fellowship in Physical Metallurgy, of the maximum value of $1,000, in the Faculty of Applied Science and Engineering will be awarded to a student registered in the School of Graduate Studies who undertakes advanced work in the field of physical metallurgy. Applications must be made to the Secretary, School of Graduate Studies.

CONSOLIDATED MINING AND SMELTING COMPANY OF CANADA, LIMITED, RESEARCH FELLOWSHIP

The Consolidated Mining and Smelting Company of Canada, Limited, offers annually a Research Fellowship in the School of Graduate Studies of $750.00 for a research related to non-ferrous metals, heavy chemicals, and fertilizers. The Fellowship is known as the "Cominco Research Fellowship."

It is open to graduates in Science, Engineering, or Agriculture of a recognized university and preferably a British subject resident in Canada.

Applications for the Fellowship must be made to the Secretary of the School of Graduate Studies, not later than September 1.

CANADIAN INSTITUTE OF STEEL CONSTRUCTION RESEARCH FELLOWSHIP

This fellowship, donated by the Canadian Institute of Steel Construction, is offered to encourage scientific research in steel construction. It is open to honour graduates in engineering of any recognized university. The holder of the fellowship must be registered in the School of Graduate Studies as a student proceeding to a post-graduate degree and must carry out a programme of study and research prescribed by the School of Graduate Studies. The annual value of the fellowship is not less than $750 for a seven months term and not more than $1,200 for a ten months term.

Application should be made to the Secretary of the School of Graduate Studies not later than September 1 and should be accompanied by an official transcript of the applicant's undergraduate record, together with a statement of his engineering experience.

CANADIAN LUMBERMEN'S ASSOCIATION TIMBER RESEARCH FELLOWSHIP

This fellowship, donated by the Canadian Lumbermen's Association, is offered to encourage advanced study and research in timber engineering. It is open to graduates in engineering and graduates in forestry of any recognized university. The fellow must be registered in the School of Graduate Studies as a student proceeding to a post-graduate degree and must carry out a prescribed programme of study and research in both

engineering and forestry. It is intended that the work of this programme will extend over a period of two academic years. The annual value of the fellowship is $1,000, all of which might not be granted to one student.

Application should be made to the Secretary of the School of Graduate Studies not later than September 1 and should be accompanied by an official transcript of the applicant's undergraduate record, together with a statement of his experience in the forestry and construction fields.

IMPERIAL OIL GRADUATE RESEARCH FELLOWSHIPS

Imperial Oil Limited, in 1946, established for annual competition four research fellowships of the value of $3,000.00 each, ($1,000.00 per year payable in Canadian funds for a maximum of three years), open to graduates of any approved university in Canada. These fellowships are offered for graduate work leading to a Doctor's or Master's degree in the fields of Petroleum Engineering, Petroleum Geology, Chemistry or Chemical Engineering, and Mechanical Engineering. Nomination of students for these fellowships is made by the University—such nominations being submitted to the Imperial Oil Scholarship Committee, Imperial Oil Limited, 56 Church Street, Toronto, not later than June 1st, each year. Nomination forms and information as to the terms of fellowships are available at the University Registrar's office.

THE GEORGE T. GOULSTONE FELLOWSHIP IN ARCHITECTURE

The late George T. Goulstone of New York City bequeathed to the University the sum of $10,000.00, to be known as the Goulstone Foundation, the income therefrom to be paid to such worthy student or students of the University as may be designated from time to time, with the wish that those enjoying such awards devote themselves in the main to the study of Georgian Architecture in England.

In order to carry out this wish, the George T. Goulstone Fellowship in Architecture has been established, open to graduates in Architecture of this University, with a value of the accumulated income from the Goulstone Foundation or such portion thereof as the Council of the Faculty may recommend.

Application should be made to the Secretary of the Faculty.

WALLBERG RESEARCH FELLOWSHIPS

Two Wallberg Research Fellowships, derived from the Wallberg Bequest, of a value of $1,500.00 each are offered to graduates of a recognized university pursuing advanced study and research in any branch of engineering or in architecture, provided the necessary staff and facilities are available in the field of study or investigation proposed by the applicants. Holders of the fellowships will be required to register in the School of Graduate Studies as candidates for an advanced degree. Awards will be made only if satisfactory applicants are available.

Recommendation of candidates and subjects of research to the School of Graduate Studies will be made by a committee composed of the Dean of the Faculty of Applied Science and Engineering, who will act as chairman, three members of the staff of the Faculty, and three members of the Engineering Alumni Association.

SPRUCE FALLS POWER AND PAPER COMPANY, LIMITED, FELLOWSHIPS

The James Herbert White Fellowship in Forestry, the Robert W. Lyons Fellowship in Forestry, the Cola G. Parker Fellowship in Forestry, the Charles H. Sage Fellowship in Applied Science, the Egerton S. Noble Fellowship in Applied Science, and the Arthur Hayes Sulzberger Fellowship in Applied Science, each the gift of the Spruce Falls Power and Paper Company, Limited, are established for the encouragement of research in the Faculties of Applied Science and Engineering and of Forestry. They are open to graduates of the University of Toronto and of other recognized universities, but are restricted to Canadian citizens.

The value of each Fellowship is up to $750. Application, together with a transcript of his academic record and an outline of the advanced study and research which he proposes to undertake, should be sent to the Secretary of the School of Graduate Studies, not later than September 1st.

ALGOMA ORE PROPERTIES LIMITED GRADUATE FELLOWSHIPS

Algoma Ore Properties Limited, Sault Ste. Marie, Ontario, has provided the funds to establish two Graduate Fellowships of a value of $2,200.00 each to be available in the Session 1950-51 or later. In awarding the fellowships, in so far as practicable, they will be given to those who have enjoyed Algoma Ore Properties Limited Undergraduate Scholarships, and who have maintained their high academic performance. They will be given only for graduate work in Mining Engineering, Metallurgical Engineering, or Mining Geology, in the University of Toronto.

THE 1940 TORONTO FUND

The 1940 Toronto Fund, the gift of Oxford University, of the value of £3000, was set up in 1940 by the parents of Oxford children who were taken into Canadian and American homes during the War. Recommendations for grants from the income from the Fund will be made from time to time by the Senate of the University of Toronto to members of the University "who wish to go to Great Britain for the purpose of study, research, or any general educational purpose, taking education in the widest possible sense." Each applicant for a grant from this Fund must submit his application to the University Registrar not later than March 1 together with an outline of the study or research which he proposes to undertake in Great Britain, or the general educational purpose which he has in mind in going there.

THE RAYMOND PRIESTLEY FELLOWSHIP

The University of Birmingham being "anxious to mark its indebtedness and its gratitude" for the hospitality shown during the Second World War to children of members of its teaching staff by members of the University of Toronto, has set aside a research fellowship to be held by a graduate of the University of Toronto. This fellowship, to be known as the Raymond Priestley Fellowship, of the value of £450 per annum as well as the cost of the return passage from Canada, is available for graduates, both men and women, preferably those who have already shown some capacity for and interest in research. The fellowship will normally be awarded for a period of three years. It is tenable in any faculty of the University of Birmingham. The Fellow will undertake research and may, if he wishes, be a candidate for a higher degree at the University of Birmingham. The selection of the candidate will be made by the University of Toronto. The process of selection will include negotiation with the head of the department concerned in the University of Birmingham to ensure that there is in the University opportunity for the pursuit of the particular line of research required. Applications must be submitted to the University Registrar not later than March 1, together with transcripts of undergraduate and graduate records and outlines of the research to be undertaken at the University of Birmingham.

THE ROYAL INSTITUTION OF GREAT BRITAIN SCIENCE RESEARCH SCHOLARSHIPS

A scholarship of the value of £350 per annum with a possible additional allowance of £50, to be held ordinarily for a period of two years, will be offered each year to a candidate from one of the universities of Canada, Australia, New Zealand and South Africa, and is tenable only in the Davy Faraday Research Laboratory of the Royal Institution, London. No candidates will be considered except those who have been recommended for the 1851 Exhibition Science Research scholarships, and candidates who wish to be considered also for the Royal Institution scholarships are requested to state this clearly in the application for an 1851 scholarship. No other application to the Royal Institution is necessary. Copies of the regulations relating to these scholarships may be obtained from the University Registrar.

UNIVERSITY OF TORONTO GENERAL BURSARIES

The Board of Governors has established a fund to provide bursaries for deserving students who without financial assistance cannot continue their formal education. Further information may be obtained from the Secretary of the Faculty.

DOMINION-PROVINCIAL STUDENT-AID BURSARIES

Under this programme, Bursaries may be awarded to students in financial need who are resident in Ontario and who are in attendance at the University of Toronto. Further information may be obtained from the Secretary of the Faculty.

LOAN FUNDS

From the loan funds mentioned below, small loans can be made to students who are in urgent need of assistance. The funds are not large and the loans must accordingly be restricted, both in amount and number, and principally to students in the Third and Fourth Years.

Enquiries for loans from any of the following funds should be made at the office of the Secretary of the Faculty:

Engineering Society Loan Fund
Elizabeth Speller Memorial Fund
James W. Crocker Memorial Fund
Harry F. Bennett Educational Fund.

ENGINEERING SOCIETY LOAN FUND

In 1932 the Engineering Society repaid to the Board of Governors a series of annual grants which, over a period of years, had been made to the Society for special purposes. The Board of Governors, appreciating this action, set aside this sum, to be known as the Engineering Society Loan Fund, to provide loans to students of the Faculty of Applied Science and Engineering. The administration of the fund is carried out by a Committee appointed by the Board. The fund is not large, and only small loans can be made to relatively few students. Further inquiries should be made at the office of the Secretary of the Faculty.

ELIZABETH SPELLER MEMORIAL FUND

Through the generosity of Dr. F. N. Speller, of the class of 1893, the "Elizabeth Speller Memorial Fund" has been established, the annual income from which is available for loans to worthy students of the Third and Fourth Years of this Faculty. Applications for loans from this Fund should be made to the Secretary of the Faculty.

JAMES W. CROCKER MEMORIAL LOAN FUND

This fund was established by Mrs. William Crocker in memory of her son, James W. Crocker, a graduate in Mining Engineering in 1938, who was killed in an accident in a mine in the same year.

HARRY F. BENNETT EDUCATIONAL FUND

This fund was established by subscription from members of The Engineering Institute of Canada in memory of the late Harry F. Bennett, M.E.I.C., who for six years prior to his death in 1946 was chairman of the Institute's Committee on the Training and Welfare of the Young Engineer, and who accomplished so much in this field by untiring efforts.

One purpose of the fund is to make loans to deserving students who need financial assistance to enable them to study engineering sciences at university level, and who have proved themselves by successfully completing their first year in engineering or the equivalent.

Loans will be made largely on the basis of character and to men who seem likely to develop the high professional standards which are essential to leadership in engineering science. A student who has been aided by this fund should feel that high obligations are placed on him; obligations to the subscribers, to the trustees, and to those coming after him who in turn can receive help as his loan is repaid.

Application forms may be obtained at the Faculty Office. The regulations are simple and the application of any worth-while student will be given immediate and careful attention.

SECTION XII. LIBRARIES AND LABORATORIES

THE UNIVERSITY LIBRARY

The University Library building is situated on the east side of the lawn that lies to the south of University College. It contains reading-rooms for men and for women, a law reading-room, and a medical reading-room, besides departmental studies which may be used as study rooms for honour students in the various departments in which the professors hold seminar courses, and private studies intended for advanced students engaged in research work. The University Library maintains also reserved book reading-rooms in University College and in the Economics Building.

During term the hours are:

University Library............................8.45 a.m. to 10.00 p.m.
except on Sundays and holidays.

University College reading-room................8.45 a.m. to 10.00 p.m.
(12.30 p.m. on Saturdays)

Reading Room, Economics building..............9.00 a.m. to 5.00 p.m.
(12.00 noon on Saturdays)

During the Summer vacation, the Library building is open from 9 a.m. to 4 p.m. (except on Saturdays and Sundays); and the two reading-rooms are closed.

Books in general demand may not be taken out of the Library until 3 p.m., when they are lent for the night to be returned by ten o'clock the following morning. On Friday afternoons, these books are lent for the week-end. Books in the main library not in general demand may, on application, be borrowed for a longer period.

Many of the departments of the University, especially those that maintain laboratories or are at some distance from the University Library, have "departmental libraries"; but these, though authorized by the Library Committee of the University, are under departmental control, and books from the main Library are transferred to them at the discretion of the Librarian of the University. The regulations governing the use of books in the departmental libraries, and the hours when they are open, are determined in each case by the department concerned, and vary greatly from one department to another. Transfer of a particular book to one of these libraries is indicated in the public catalogue in the main Library.

In the University Library students of the humanities possess an extensive laboratory. It is not only a storehouse, but a workshop in which selected materials are indexed and arranged so as to be useful. The Library does not attempt to supply textbooks; but for general and specialized reading it possesses more than half a million volumes. It subscribes to about four thousand periodicals, and is a Canadian depository for United Nations publications.

AJAX DIVISION LIBRARIES

There are two main libraries at Ajax, the Technical Library and the General or Circulating Library.

The Technical Library is located in the Academic area, close to the lecture rooms and laboratories, and contains the books and periodicals recommended in connection with the courses of instruction. It provides facilities for study during working hours; and books may also be borrowed from it for short periods.

The General or Circulating Library is located in the northern area near the residences. It contains a collection of general reference works, and also a wide variety of both educational and recreational reading. Books may be borrowed without time limit, but subject to recall.

Books not available in Ajax may be borrowed from the University Library in Toronto, either through the Technical Library or through the Circulating Library, provided they are not in urgent demand in the University Library.

DEPARTMENTAL LIBRARIES

Periodicals and other literature in the University Library of special interest to the students of this faculty have been housed in the Electrical, Engineering, Mechanical, and Mining Buildings for convenient reference.

These departmental libraries are situated as follows:

Applied Physics	Room 22, Engineering Bldg.
Architecture	Room 37, Engineering Bldg.
Chemical Engineering	Room 53½, Mining Bldg.
Civil Engineering	Room 25, Electrical Bldg.
	Room 22, Engineering Bldg.
Electrical Engineering	Room 25, Electrical Bldg.
Geological Sciences	Room 74 , Mining Bldg.
Mechanical Engineering	Room 6, Mechanical Bldg.
Metallurgical Engineering	Room 37, Mining Bldg.
Mining Engineering	Room 314, Mill Bldg.

CIVIL ENGINEERING LABORATORIES

There are four main divisions comprising these laboratories, namely: Cement, Highway, Soil Mechanics, and Mechanics of Materials.

CEMENT LABORATORY

The Cement laboratory contains all the appliances necessary in making the usual physical tests on Portland cement. It is supplied with cabinets and apparatus for individual work and various shot machines designed for tension and transverse tests. In addition, the laboratory is equipped with moulds, knock-down forms for beams, drying ovens, a curing room controlled for temperature and humidity, and other apparatus required in investigating the properties of aggregates and concrete mixtures.

HIGHWAY LABORATORY

The Highway laboratory is equipped to carry out investigations in bituminous and non-bituminous materials used in highway construction and maintenance. Among the more important pieces of apparatus are the Deval abrasion, the Page Impact, and the Dorry Hardness machines, a standard brick rattler, jaw crusher, diamond core drill with rock saw and grinding lap, bituminous extractor, viscosimeters, ductility and penetration machines, cementation test apparatus, electric ovens, constant temperature baths and special equipment for the determination of the properties of subsoils.

SOIL MECHANICS LABORATORY

The Soil Mechanics laboratory is supplied with apparatus designed for the investigation of the physical properties of soils. It contains a mechanical centrifuge for determining moisture equivalents, Dow liquid limit machines, consolidation and shear machines, Proctor compaction test apparatus, a penetration and bearing power machine, sampling tools, dispersing apparatus, hydrometers, etc., and a device for demonstrating the quicksand phenomena, permeameters.

MECHANICS OF MATERIALS LABORATORY

The Mechanics of Materials laboratory is available for the scientific and commercial testing of materials of construction such as iron, steel, timber, concrete, and masonry. The equipment includes a Riehle 400,000-lb. three screw power universal testing machine, with a capacity for beams and girders up to 28 inches in width and 16 feet in span, and for specimens in tension and compression up to 10 feet in length, a Riehle 200,000-lb. screw power universal testing machine, taking beams 18 feet in span, and tension and compression specimens up to 12 feet in length, a Riehle 100,000-lb. screw power universal testing machine, a Riehle 20,000-lb. screw power universal testing machine, an Olsen 20,000-lb. hand-power, wire testing machine, specially fitted for testing wooden columns with both fixed and pivoted ends, an Olsen 20,000-lb. hand-power universal testing machine, especially adapted for testing long columns, an Olsen torsion machine of 140,000 inch-pounds capacity for testing the strength and elasticity of shafts and rods up to 2 inches in diameter and 10 feet in length; a hand-power torsion machine of simple mechanical design for testing short shafts of a maximum diameter of one inch, a Riehle 5,000-lb. transverse load testing machine for flexural tests of bars of wood and metal up to 48 inches in length, an Olsen 200-lb. tension testing machine, designed for the testing of textiles.

There are also special machines, such as an Olsen (Izod) pendulum impact machine; Brinell, scleroscope, and Firth Hardometer for hardness testing; an Avery repeated stress (fatigue) machine of the rotating beam type; proving levers and standard weights, an elastic ring, and an Amsler 60,000-lb. box, for calibrating purposes.

The accessory equipment includes Berry and Olsen strain gauges, a Nalder dividing engine, Beggs deformeter gauges, a Fereday-Palmer stress recorder—an instrument ideally suited for determining stresses in actual structure — apparatus for measuring angular deformation, a strainometer for use in determining Poisson's ratio.

In addition to the above, there are available a large number of strainometers of the usual degree of precision. These include the Bauschinger, Martens, Unwin, Ames, Riehle, Johnson, Huggenberger, De Forest scratch gauge, and other types.

MINING ENGINEERING LABORATORIES

During 1931 the building containing these laboratories was entirely rebuilt and greatly enlarged. The new building is 72 ft. x 100 ft., and is four stories high with a basement under half of it. The top floor and part of the third are occupied by the assaying laboratories. The rest of the building is given up to the ore dressing and mining laboratories, the commodious library and study rooms, lavatory and shower baths, rooms for the staff, two rooms for research in ore dressing, a model and map room, and storerooms.

ASSAYING LABORATORY

The East and West Fire Assay laboratories occupy the top floor of the Mill Building. They are identical, with preparation, furnace, and balance rooms in sequence, while between and common to these is a supply room, and another for chemical work. This arrangement allows a natural flow of operations from sample preparation to final weighing. Equipment in general is ample to give individual work to 32 students, thus encouraging original effort and conserving time.

The grinding rooms have a Sturtevant 2 x 6 jaw crusher, a McCool 8″ eccentric plate pulverizer, buck-boards, samplers, screens, and cupel machines. A special laboratory sampler gives samples of indisputable similarity, thus confining variations in students' assays, to their work.

Each furnace room has six Fletcher-Russell gas, and two D.F.C. oil furnaces. Parting cabinets have fan exhaust and direct illumination. Each student is allotted a work place equipped with a pulp balance, weights, tools, fluxes, and locker for individual work.

The bead balances are modern instruments by Ainsworth, Becker, Heusser, Keller, Oertling, Thompson, and Voland. Some have special rider devices and a sensitivity of 0.002 milligram. Each has independent lighting and is mounted on a cork insulated pier.

A sample room houses a wide variety of ores, mill products, mattes, bullion, and alloys from typical mines and smelters. Thesis, service, and study rooms on the third floor provide facilities and equipment for student research. Two staff rooms are used for the determinations necessary for instructional purposes and for research. A Hoskins electric furnace with Leeds-Northrup controllers and recorder is installed here. Other equipment includes pyrometers, microscope, electrolytic apparatus, and bullion rolls.

MINING LABORATORY

The Mining laboratory makes use of the ore dressing equipment as required. It is also equipped with an Ingersoll-Rand type ER-1 compressor and a variety of air driven rock drills representing the development of this machine. Blocks of synthetic ore for practising sampling and rock drilling are made up as required. A laboratory has been completed for the study of ventilation problems, air conditioning, dust counts, etc. In the main basement are bins for the accommodation of a large variety of ores from various mining districts.

ORE DRESSING LABORATORY

The main Ore Dressing laboratory, 72 ft. x 53 ft. x 22 ft. high, is equipped with the old five stamp battery with amalgamation plates, Wilfley table, Deister Plato table, Deister slime table, an old-fashioned buddle, and classifiers. Parallel with the stamp mill is a ball mill 30 in. x 24 in., which can be used alternatively with the stamps in connection with the concentrating tables. At one side of this main laboratory is apparatus representing the complete flow-sheet of a modern concentrator designed for continuous operation at the rate of 50 to 100 lb. per hour. This plant consists of feeders, two rod mills and a ball mill each 18 in. x 12 in., with classifiers, two Wilfley tables, a Dorr type thickener, a six-cell Fahrenwald Sub A flotation unit, a conditioner, a small pilot Wilfley table, and a Genter thickener. Another laboratory, 70 ft. x 25 ft., is set aside for batch work, and contains a variety of flotation machines, small ball and rod mills, small jigs, apparatus for cyanide tests and for tests in magnetic concentration. Other rooms are set apart for hand screening, microscopes, balances, a chemical room, and a room for roasting and other high temperature testing of ores in connection with ore dressing. For further research in ore dressing, there are available, Haultain Superpanners and Infrasizers, briquetting apparatus and metal lap machines for the polishing of briquettes in the study of minerals and mill products. The laboratory is also equipped with a Panphot microscope and accessories.

The Crushing laboratory contains a Hadfield gyratory crusher, a set of rolls 16 in. x 12 in., two small Dodge crushers, two sets of miniature rolls, two disc grinders, and a dry screening machine of the Feraris type. Adjoining this room is a large room for practising sampling methods.

MECHANICAL ENGINEERING LABORATORIES

HEAT ENGINE LABORATORY

This laboratory is located on the ground floor of the Mechanical Building, and comprises an experimental boiler house, a large engine room, a heat transmission room, and an instrument room.

The student's work covers examination and testing of a wide range of engineering apparatus, namely: Steam Power Plant equipment, including boilers, reciprocating engines, turbines, condensers and auxiliaries; Internal Combustion engines, including gas, gasoline and heavy oil engines for

various types of service, Air Compressors of the reciprocating and rotary types, Heating, Ventilating and Air Conditioning equipment, Refrigeration Plants, Heat Exchangers, and Insulation.

The student is given practical experience in performing the analysis and testing of solid, liquid, and gaseous fuels, the determination of the octane rating of gasoline, the testing of belts, governors, lubricating oils and bearings, and the balancing of rotating masses.

HYDRAULIC LABORATORY

The present laboratory occupies two floors of the Mechanical Building, each of 40 ft. x 112 ft., and is designed for instruction and research in all phases of fluid mechanics. Among the subjects considered are the measurements of flow of gasses and liquids, friction losses in pipes and fittings, the performance of turbines, pumps and fans. In addition, experiments dealing with cavitation, flow in open channels and other special subjects are available. A new laboratory designed primarily for open channel and model work will be available in the basement of the new wing of the Mechanical Building which is presently under construction.

CHEMICAL ENGINEERING LABORATORIES

The Chemical laboratories are situated in the Mining Building, and are supplied with the usual modern equipment.

Seven large laboratories, each with its own balance room, and seventeen small laboratories are in steady use. Some of the latter are specially equipped for work in such fields as gas analysis, calorimetry, polarimetry, hydrogen ion investigations, and water analysis. A fireproof room is provided for work with volatile solvents and organic analysis, and special equipment for semi-micro analysis is permanently maintained. Nine of the small laboratories are set apart for undergraduate and graduate research, and a room is set apart for the construction of glass apparatus by the glassblower connected with the department, in which instruction in glassblowing is given to students. One of the large laboratories, approximately forty feet square, is equipped for the experimental study of chemical engineering and industrial chemistry. Among the apparatus installed there are: a stoneware column for the investigation of the absorption of gases by liquids, fractionating still, heat transfer apparatus filter press, vacuum evaporator, sulphonator, fusion pots, autoclaves, jacketed kettle, tanks, pumps, meters, and other necessary accessories. Each of these is used by undergraduates, and is further employed from time to time in research.

ELECTRICAL ENGINEERING LABORATORIES

The Electrical laboratories, located in the Electrical Building, are equipped for studies related to principles discussed in lecture courses rather than for routine tests.

The power services to all laboratories are 230-115 volts, direct current; 115 volts, three phase, 25 cycles; and 115 volts, three phase, 60 cycles. Power for the laboratories is supplied by the University Central Heating and Power Plant in the form of 230-115 volts, three wire, direct current. The alternating current services are supplied from two main motor-generator sets which are equipped with automatic voltage and speed regulators.

These different services, combined with a system of spare conductors, make it possible to conduct a great variety of experiments in any one of the laboratories. In all laboratories the measuring instruments are of the highest quality.

ALTERNATING CURRENT MACHINE LABORATORY

The Alternating Current Machine laboratory, located on the first floor, contains the main 25-cycle and 60-cycle service sets referred to above. For experimental purposes the following equipment is available: two 15 kva. motor generator sets, d.c. to 60-cycle a.c.; two 15 kva. motor generator sets, d.c. to 25-cycle a.c.; two 10 kva. 60-cycle phase displacement dynamometer sets; a 25 h.p. low speed (322 r.p.m.) 60-cycle synchronous machine which produces an emf. wave very close to sine form; a 5 kw. 60-cycle synchronous converter; a mercury-arc rectifier; transformers; a.c. motors of all types; a model transmission line; two electromagnetic and two cathode ray oscillographs; and all necessary auxiliary apparatus.

DIRECT CURRENT MACHINE LABORATORY

The Direct Current Machine laboratory, located on the second floor, has a 40 kw. 230 volts d.c. to 115 volts d.c. motor-generator set with Tirrill regulator for special tests. Other equipment includes a number of 5 to 10 kw. motor-generator sets for d.c. generator tests; shunt, series and compound motors with and without interpoles; and other necessary apparatus such as loading racks, rheostats, circuit breakers, prony brakes and motor starters.

ELECTRICAL MEASUREMENTS LABORATORY

The Electrical Measurements laboratory, located on the top floor, is fitted with a convenient arrangement of power supply including a very flexible storage battery service and a 1,000-cycle service in addition to the standard a.c. and d.c. services. The equipment includes galvanometers, resistance boxes, Wheatstone bridges, shunts, potentiometers, standard cells, bond testers, condensers, and such other apparatus required for making a great variety of studies in measurements by direct and alternating current methods.

COMMUNICATION LABORATORY

The Communication laboratory, located on the top floor, is equipped for setting up and measuring vacuum tube circuits of all usual types; and for measuring the properties of networks at both low and high frequencies. Cathode ray oscillographs, harmonic analyzers, amplifiers for

bridge balance, etc., are available. A 1,000-cycle supply of good wave form is located at all measuring points in the laboratory. A separate room is treated acoustically and equipped with the necessary apparatus for the study of electrical reproduction of sound.

ENGINEERING ELECTRONICS LABORATORY

The Engineering Electronics Laboratory, located on the top floor, is equipped for experiments on electronic applications in the industrial power frequency fields. The equipment includes cathode ray oscillographs of twin beam and conventional types, hot cathode rectifiers, pool cathode mercury arc rectifiers, thyratrons, ignitrons, photo-electric cells and the necessary auxiliary equipment much as power supplies, transformers, amplifiers, and measuring instruments. The equipment is so designed that circuits for the study of fundamental principles may be arranged easily and quickly. While typical commercial tubes and components are employed, they are used in such a manner as to give the greatest educational value rather than to illustrate finished commercial products.

METALLURGICAL ENGINEERING LABORATORIES

These laboratories, in the east end of the Mining Building, occupy approximately 3,600 square feet on the basement floor and the same space immediately above on the ground floor. The furnace room contains a motor driven Connersville blower, several gas-fired furnaces, and two small blast furnaces. The larger electric furnaces of the Department of Chemistry (Electrochemistry) are in this room. Some are supplied with direct current, others with alternating current from a 200 K.V.A. transformer. A system of flues, with hoods over all the furnaces, leads to a stack through which gases are pulled by a fan.

The department has recently installed a 50 k.v.a. 60 cycle service which permits the operation of modern experimental equipment. A 7.5 k.v.a. and a 15 k.w. 300,000 cycle high frequency converter (on loan from National Research Council) are available for special melting and heat treatment experiments. A Detroit Rocking Arc Furnace of latest type is now available for the production of ferrous and non-ferrous alloys.

Hydro-metallurgical equipment includes apparatus for leaching and electrolytic precipitation in circulating systems.

Situated in these two rooms, also, is most of the equipment used in the teaching of ceramics and non-metallic industrial materials. The apparatus includes a dry pan, a small dry press, a plunger machine with tile and hollow ware dies, an Abbé six-jar ball mill, a recuperative down draft clay testing furnace of brick construction, a small Seger test furnace, a high temperature oxygen acetylene furnace, a high temperature electric muffle furnace heated by "globars", and standard screens, volumeters, elutriation apparatus, driers, and such sundries as are necessary for clay testing.

The upper floor is divided into laboratories, a library, store rooms, and offices. The laboratories are for metallurgical analysis; heat treatment

and pyrometry; grinding, polishing, and etching; metallographic room, with two adjoining dark rooms.

The laboratory for metallurgical analysis is well equipped to give students training in mill and smelter methods, the analysis of ores, furnace products, ferrous and non-ferrous alloys, and specialized ceramic bodies.

In the heat treatment and pyrometry laboratory there are a number of gas and electric furnaces, a Leeds and Northrup micromax potentiometer, a disappearing filament pyrometer, a radiation pyrometer, and thermocouples for use with millivoltmeter or potentiometer.

For grinding and polishing there are provided many sets of emery papers and six motor-driven polishing wheels.

The metallographic room is equipped with a horizontal Bausch & Lomb photomicrographic camera, a Leitz micro-camera attachment, two vertical cameras, and nine metallographic microscopes.

The laboratories also contain a "Tensometer" for making tensile tests, notch bar tests and Brinell tests on small test pieces, a Leeds and Northrup type "K" potentiometer for determining critical points, a Rockwell hardness testing machine, a Shore scleroscope, an emery cutting disc, and a mechanical saw.

The laboratory workshop is equipped with usual machine tools, together with acetylene and arc welding equipment.

APPLIED PHYSICS LABORATORIES

The Applied Physics laboratories, situated in the Engineering Building, are equipped as follows:

The Photometric laboratory is equipped with precision and portable photometers for the measurement of candle-power, illumination, and brightness; integrating spheres for determining the luminous output and efficiency of lamps and luminaires; and colorimeters, spectro-photometers, and flicker photometers for the measurement of colour. Standards of candle power, luminous flux, and colour temperature are maintained and a 132-volt storage battery with all electrical controls and meters necessary for precise photometry are provided.

The Illumination Design laboratory is equipped for demonstrating and measuring the performance of lighting installations.

The Optics laboratory is equipped with optical benches, etc., for the testing of lenses, and with examples of various optical instruments for instruction in their theory and applications.

The Photographic laboratory is equipped with cameras, dark rooms, and accessories for practical work in photography, and with sensitometers, spectrographs, and densitometers for the testing of photographic materials. A Zeiss phototheodolite, stereoscopes, stereocomparator, and plotting apparatus are provided for instruction in photographic surveying.

The Acoustical laboratory is equipped with the ordinary apparatus, such as forks, pipes, strings, etc., for illustrating the elementary laws of acoustics. There are also two rooms for work in sound transmission and absorption, equipped with an audio-frequency oscillator for the production of sounds of constant intensity, and microphones and amplifiers for, reception.

UNIVERSITY SURVEY CAMP

In 1920 the University purchased approximately 175 acres of land comprising a tract of field, woodland, and lake front property in the County of Haliburton, and erected permanent buildings for the use of students in Civil Engineering, Mining Engineering, Mining Geology, and Architecture, as well as for other students taking special work. The country is broken and rolling, and with the numerous small lakes and streams in the immediate vicinity, is admirably suited for work and the various problems that arise in practical surveying. The camp is at an elevation of about 1,000 feet above sea level and a secondary triangulation has been carried out, the stations of which are connected with the primary stations of the Geodetic Survey of Canada. Permanent bench marks have been established and connected up with the precise level net of Canada.

The Camp may be reached by the Canadian National Railways, via Lindsay to Gelert, where conveyances are always on hand to drive direct to the camp by way of Minden, a distance of 12 miles. There is also a daily bus service from Lindsay to Minden.

The Camp, located 4 miles south of Minden, on the west side of Gull Lake, can be reached by road after leaving the main Provincial highway at Minden. There are four main buildings, including a Dormitory, Administration, Staff, and Dining Hall Building, which are suitably furnished and provided with electric lighting and drafting accommodation. Accommodation for 80 students can be provided, and a large proportion of the equipment of the Department is transported to the Camp for use during the summer session.

The charge for accommodation at the 1949 camp will probably be $1.75 a day.

Mail, telegrams, or telephone messages should be addressed to "University Survey Camp, Minden, Ontario".

METROLOGICAL LABORATORY

The Department of Surveying and Geodesy is provided with all the ordinary field instruments, such as transits, levels, compasses, micrometers, sextants, planimeters, plane tables, tapes, chains, etc., with which is carried on the instruction in practical field operations as detailed elsewhere.

A small laboratory is also established in the basement of the observatory described below, containing the necessary instruments for the refined measurements of geodetic surveying; as, a standard yard and metre, a

Rogers 10-foot comparator, an invar base measuring apparatus, a Kater's pendulum with vacuum chamber, a level trier, micrometer microscopes, etc.

The geodetic observatory in connection with this department is used for the instruction of students of the Fourth Year in taking observations for time, latitude, longitude, and azimuth by the precise methods used in connection with a geodetic survey. It contains a 10-inch theodolite and zenith telescope by Troughton & Simms; an astronomical transit instrument and an 8-inch theodolite by Cooke; two electro-chronographs; a Howard astronomical clock; a Dent sideral clock; a Dent sideral break-circuit chronometer; a wireless receiving instrument; arithmometers, etc.

AERODYNAMIC LABORATORY

The Aerodynamic Laboratory is fully equipped with an improved 4-ft. Royal Aircraft Establishment type wind channel, aerodynamic balance, micromanometers and other necessary instruments.

Air speeds of 80 feet per second can be secured in a stream of great steadiness and uniformity and higher speeds with some sacrifice in steadiness.

The work done in the Laboratory includes the investigation of problems in aerodynamics, tests of air craft components, and complete machines, rating of meters, ventilators, radiators, etc., and the study of the effect of wind pressure on structures, chimneys, etc.

ONTARIO DEPARTMENT OF HEALTH LABORATORY

Through the courtesy of the Provincial Department of Health, the facilities of the well-equipped experimental laboratory, which the Department operates at Stanley Park (807 Richmond Street West), have been placed at the service of the University for the investigation of problems associated with all phases of Sanitary Engineering. Equipment and means are available for study and research in the various processes employed in sewage treatment, the different methods of water treatment, and the bacteriological and chemical examinations on water, sewage, air, milk, and all factors in sanitation.

ELECTROCHEMICAL LABORATORIES

The Electrochemical laboratories, which are situated in the Mining Building, are provided with special facilities for electrolytic work, including a large storage battery and electroplating dynamo with tanks, as well as a set of apparatus and electrical measuring instruments, for both undergraduate work and research. The experimental work on electric furnaces is carried out in a large furnace room in the basement, occupied jointly by the Department of Metallurgical Engineering and the Department of Chemistry (Electrochemistry). The equipment for this purpose comprises a 120 kw., 220 volt supply of direct current from the main power house through a switchboard, rheostats, circuit-breaker, and instruments

to a set of distributing bus-bars, and a 200 k.v.a. transformer stepping down from 2,200 volts to 30-120 volts in 3 and 6 volt steps, which supplies alternating current at 25 cycles. There is a complete set of A.C. instruments, circuit-breakers, oil-switches, relays, automatic regulating winches, etc., and a Northrup high frequency furnace with its transformer is also installed. The two departments co-operate in the use of a Hoskin carbon plate furnace and a resistor tunnel furnace. Facilities for the study of high current carbon arcs and the thermal behaviour of refractories are also provided.

GEOLOGICAL LABORATORIES

The Geological laboratories are equipped for the study of geology from the modern viewpoint. Collections of rocks and minerals, models and natural specimens illustrating various geological features, topographic and geological maps for exercises in map reading, and fossils are all employed in the study of general geology. Typical index fossils are utilized, along with geological maps, in historical geology.

In the Economic Geology laboratory, numerous suites of specimens of ores and rocks illustrate the nature and occurrence of the deposits in many mining camps. A set of building stones, uncut, cut, and polished, is available for a course on that subject. These materials are studied megascopically and microscopically to determine the character and associations of their mineral constituents. The Metamorphic Geology laboratory is supplied with specimens, thin sections, and petrographic microscopes for the study of metamorphic minerals and the changes that rocks undergo in thermal and dynamic metamorphism. Hand specimens and thin sections of suites of rocks from numerous Precambrian areas are also available for work in Precambrian geology. Facilities are available for sawing and polishing specimens of ores, and rocks, and for making thin sections.

For work in structural geology, natural specimens and geological maps exhibiting complex structural conditions and structural problems illustrated by diagrams and drill logs, are extensively employed. For field methods in geology, the laboratories are supplied with geological and topographic maps, survey instruments, and various other equipment, so that work in the laboratory may supplement that in the field.

MINERALOGICAL LABORATORIES

The Mineralogical laboratories in the Mining Building provide facilities for most types of investigation involving minerals, crystals, and rocks.

Courses in laboratory work in the personal examination of type sets of named minerals, crystals, and rocks serve to illustrate the introductory lectures. More advanced work is provided in the identification of unknown minerals by physical tests, blowpipe, and other methods.

To encourage the study of pure crystallography, the laboratories are supplied with goniometers of the various types, crystal models, appliances

for the cutting of oriented crystal sections and for their physical examination. Practical petrography is carried on in rooms provided with type sets of rocks, both macroscopic and microscopic. Advanced students are taught to make thin sections of rocks and polished sections of opaque minerals, and to study them microscopically.

The laboratory for the preparation of thin sections of rocks and minerals is provided with electric diamond saws and grinding appliances for the various types of work incidental to the preparation of thin sections. It is also equipped for the preparation of polished specimens for the microscopic examination of the opaque ore minerals.

The department is equipped with petrological and mineralographical microscopes, so that it is possible to provide advanced students with instruments and sets of thin sections and polished minerals for their own special use. Sets of index liquids and a universal stage are available for students interested in more advanced methods for determining the optical properties of crystals.

A well equipped X-ray laboratory, with suitable goniometers for the study of crystal structure, is available to qualified advanced students.

MUSEUM

The ROYAL ONTARIO MUSEUM, with exhibits in Archaeology, Geology and Mineralogy, Palaeontology and Zoology, is situated at the southwest corner of Bloor Street and Queen's Park.

Students of the University in all departments are recommended to avail themselves of the privileges of the Museum.

The museum is open on Sunday from 2 p.m. to 5 p.m., and on week days from 10 a.m. to 5 p.m. with the exception of Monday when it is closed all day. The admission is free for the public on Tuesday, Thursday, Saturday and Sunday. On other days an admission fee of fifteen cents is charged.

By a resolution of the Board of Trustees all regular students of the University may be admitted free on showing their registration cards.

SECTION XIII. DISCIPLINE

1. (*a*) There is vested in the Council of each federated university or college, and of each faculty, disciplinary jurisdiction over and entire responsibility for the conduct of their students in respect of all matters arising or occurring in or upon their respective buildings and grounds n cluding residences.

(*b*) Disciplinary jurisdiction in all other cases as respects all students is vested in the Caput.

(*c*) The Students' Administrative Council, in the discharge of all duties entrusted to it, will be supported in the due discharge of those duties by the disciplinary power of the Caput.

2. No student will be allowed to continue in attendance, whose presence is deemed by the Council of his college or faculty to be prejudicial to the interests of the University. The continuance of any student in attendance at a course in the University or the receipt by him of official certificates of standing or of graduation, is subject to such exercise of the disciplinary power of the Caput as may be necessary to enforce the regulations of the University and to maintain standards of personal conduct acceptable to the University. In the exercise of its disciplinary power, in the interest both of the University and of the student, the Caput will take into consideration the conduct of the student both inside and outside the University premises. In all cases an appeal to the Board of Governors may be made.

3. Students proceeding regularly to a degree are required to attend the courses of instruction and the examinations in all subjects prescribed for students of their respective standing, and no student will be permitted to remain in the University who persistently neglects academic work.

4. All interference on the part of any student with the personal liberty of another by arresting him, or summoning him to appear before any tribunal of students, or otherwise subjecting him to any indignity or personal violence, is forbidden by the Caput and by the Councils of the colleges and faculties.

5. No initiation ceremony involving personal violence, personal indignity, interference with personal liberty, or destruction of property, may be held by the students of any college or faculty of the University, under the penalty of suspension or expulsion.

6. Any reception of the students of the first year in any college or faculty must be approved by the Council of that college or faculty, but such reception must not involve any infraction of the regulations of the two preceding paragraphs.

7. The organizing of a parade in the streets of the city, or the taking part in such parade without the permission of the authorities of the city

on application of the Students' Administrative Council, will be regarded as a breach of discipline.

8. The use of loud-speaking equipment in University buildings or grounds, whether stationary or moving, or whether operated by students or others, is forbidden except by permission of the Board of Governors or the Caput.

9. Any individual or individuals directly responsible for an undesirable feature in connection with any Stunt Night or other entertainment given under the auspices of a student organization will be subject to disciplinary action by the Caput.

10. A committee of staff and students appointed by the Council of the college, faculty or school concerned will provide effective supervision of the programmes of all Stunt Nights and other public entertainments and will see that the programme follows the script as approved by the Council concerned.

11. The holding of beauty contests or similar exhibitions by university students, whether under the name of the University or under the auspices of organizations recognized by the Caput, is forbidden.

12. The constitution of every university society or association of students in any college, faculty or school, and all amendments to any such constitution must be submitted to the Caput. Responsibility for the conduct and programmes of each society or association of students drawing its membership from a single college, faculty or school shall rest with the Council of the college, faculty or school concerned. Responsibility for the programmes arranged by the committees of Hart House and controlled by the Board of Stewards of Hart House shall rest with the Board of Stewards. Responsibility for the conduct and programmes of every other society or association of students shall rest with the Caput.

13. The name of the University is not to be used in connection with a publication of any kind without the permission of the Caput.

14. Students of any faculty or college on the premises of colleges or faculties other than those in which they are registered shall be subject to the regulations and penalties imposed by the administrative authorities of the premises concerned.

15. A student who is under suspension, or who has been expelled from a college or faculty or from the University, will not be admitted to the University buildings or grounds.

SECTION XIV—UNIVERSITY HEALTH SERVICE

I. *Membership:* Membership in the University Health Service is obligatory for all students, with the following exceptions:

(a) Women living in residence at Victoria College, for whom the College provides its own Health Service.

(b) Students in the Pass Course for Teachers, in the School of Law, in courses leading to the degrees of Bachelor of Science in Medicine, Bachelor of Science in Dentistry and Bachelor of Pedagogy; and certain graduate and occasional students.

Those for whom the fee is not compulsory may obtain membership in the Service on payment of the fee, provided this is done at the time of registration.

II. *Objective:* The objective is the preservation and promotion of the health of the students.

III. *Facilities:* The Health Service maintains a close liaison with the Medical Service of the Department of Veterans Affairs.

(1) Medical Examination. By order of the Board of Governors, a medical examinations by the Health Service is compulsory for:

(a) Undergraduate students in their first year of attendance at the University. This examination is to be completed within one month of registration. Thereafter, the examination is to be repeated following any serious illness or accident.

(b) Any student, graduate or undergraduate, whose domicile is not in Canada. This examination is to be completed annually within one month of registration.

(c) Any student, graduate or undergraduate, where the Health Service has reason to believe that such an examination is necessary in the interest of the health of the student or of the public.

(d) Any student, graduate or undergraduate, annually, before participating in organized competitive athletics. The Health Service shall have the right to debar any student on medical grounds from participating in athletics, and also to recall any athlete for examination.

An opportunity will be afforded annually for all students to have a medical check-up if they so desire.

(2) X-Ray Chest Survey for Pulmonary Tuberculosis. By order of the Board of Governors, the following groups of students must have an x-ray examination of the chest as arranged by by the Health Service:

(a) All new students.

(b) All final year students.

(c) The following students annually:

(i) Medical students.

(ii) Students of the School of Nursing.

(iii) Students whose domicile is not in Canada.

(d) Dental students in their first year and last two years.

(e) Any student for whom it is considered necessary.

(3) A Clinic Service. Any student may consult a Staff Physician at the Health Service between the hours of 9 a.m. to 4.30 p.m., Monday to Friday, and 9 a.m. to 12:30 p.m. Saturday, while the University is in session.

It is essential that students should develop a sense of personal responsibility for the preservation and promotion of their own health, and if they are not enjoying good health, they are urged to consult a physician at this clinic.

(4) Athletic Injury Service. The University does not accept any responsibility for injuries sustained by students while engaged in physical education classes or in University athletic activities. At the discretion of the Director, however, treatment of minor conditions may be provided. Such treatment may be provided at the Men's and Women's Health Service and Hart House Surgery, under an agreement with the University Health Service. The expense of treatment obtained outside of the Department of Health Service will be met only if approved by the Director.

(5) Health Education. The Health Service provides health education through individual consultations and at times by lectures on subjects related to the preservation and promotion of health.

For students living away from home who have not a private physician, the following services will, when available, be provided for a nominal additional charge. In the case of students on rehabilitation grants, these charges will be borne by the Department of Veterans Affairs.

(6) A Visiting Service. An initial visit only will be paid for advice and disposal. A nominal charge of $1.00 during the day (9 a.m. to 6 p.m.) and $2.00 at night (6 p.m. to 9 a.m.) is made for each visit and is payable to the Chief Accountant.

(7) An Infirmary Service. This service is for the treatment of minor illnesses only, and is available from October 1st to May 15th, and during the actual session only. A charge of $3.00 per day, payable to the Chief Accountant, is made to cover cost of meals, nursing and routine medications.

IV. *Appointments for Medical Examinations.* Health Service examinations commence immediately after Labour Day in September. The examinations are by appointment only. The importance of keeping and being on time for the appointment as made, cannot be over-emphasized. Appointments for all faculties except Arts are are made through the class president. Arts students and members of the other faculties who cannot conform to the times arranged through their class presidents, may contact the Health Service direct. Undergraduate students in their initial year of attendance at the University, students whose domicile is not in Canada, and all students, graduate or undergraduate, proposing to engage in athletic activities, will be examined first. The remaining years will be offered an opportunity for examination in succession, examinations being completed early in March. Appointments for x-ray examinations of the chest are made, if possible, when the student reports for his health examination, or through the class president, or by direct contact with the Health Service. The *Varsity* should be carefully watched for notices relative to all appointments.

V. *Communicable Diseases.* Any student who has suffered from one of the communicable diseases must report to the Health Service prior to returning to the University.

VI. *Students Whose Domicile is not in Canada.* All such students are required to submit with their formal application, a certificate by a qualified medical practitioner stating that:

(1) the student is in good health and free from contagious or infectious disease, and fit to pursue his proposed course of study at this University.

(2) In addition, an x-ray film of the chest has been made within one month of the certification, and shows no evidence of tuberculosis.

They are further warned that their registration is conditional on their passing the required health examination by the University Health Service, which includes an x-ray of the chest and which must be completed within one month of registration.

VII. *Fee:* The Health Service Fee is $5.00.

VIII, *Directory:*	*Address*	*Telephone*
Health Service (Men)	43 St. George St.	MIdway 9644
Hours Open: Monday to Friday, 9 a.m. to 5 p.m. Saturday, 9 a.m. to 1 p.m.		
Health Service (Women)	43 St. George St.	MIdway 2646
Hours Open: Monday to Friday, 9 a.m. to 5.p.m. Saturday, 9 a.m. to 1 p.m.		

N.B. This office is closed during vacation periods. At these times, general information may be obtained from Health Service (Men), and those eligible for service may make an appointment to see Dr. Frances Stewart or her substitute at her private office, by telephoning KIngsdale 7537.

Hart House Surgery	Hart House	MIdway 5838
Hours Open: Monday to Friday, 5 to 6:30 p.m. (during actual session only)		local 201
Infirmary (Men)	42 St. George St.	MIdway 3017
Open October 1st to May 15th and during the actual session only		
Infirmary (Women)	Women's Union 79 St. George St.	KIngsdale 8163
Open October 1st to May 15th and during the actual session only		

Accidents which occur after 6:30 p.m. (or 1 p.m. on Saturday), or which are of a sufficiently serious nature as to require immediate hospital attendance, should be taken:

Men: To the Emergency Department of the Toronto General Hospital, College St.

Women: To the Emergency Department of the Women's College Hospital, 76 Grenville Street.

To obtain a physician after hours call KIngsdale 8163, if no answer, call KIngsdale 4141, and ask for the University Health Service physician.

UNIVERSITY HEALTH SERVICE, AJAX DIVISION

All rules, regulations and services as outlined above for the University Health Service, will apply to Ajax Division of the University Health Service.

The Ajax Division of the University Health Service is located in the University Hospital on King's Road in the northern area of the Ajax grounds.

The Hospital is fully equipped to handle all emergencies and arrange for their transfer, if indicated, to a general hospital in Toronto or the

near by communities. An ambulance is available at the Hospital at all times. There is adequate bed space to care for minor accidents and illnesses. The Hospital is equipped with a small surgery, laboratory facilities, X-ray equipment and isolation wards. Graduate nurses are in charge and medical supervision is provided by the Health Service physicians. Admission to the Hospital is on the authority of a staff physician of the Health Service.

First aid in the event of sudden illness or accidents is available at all times by telephoning the hospital, Local 116, where a physician is on duty or call.

PHYSICAL EDUCATION

By order of the Board of Governors each man proceeding to a Bachelor's degree must participate in the required Physical Education programme during the first and second year of his attendance at the University. The physical education requirements include a swimming test which must be taken before November 1st by all first year men and by men admitted to the second year from other Universities. Swimming classes are compulsory for all students who fail to pass the swimming test. All men required to take Physical Education must register at the Key Office in Hart House before October 15th.

All students taking part in Athletics or the required Physical Education programme must undergo a medical examination according to regulations laid down by the University Health Service. Arrangements for this examination may be made at the Health Service, 43 St. George Street, at any time after September 1st.

By order of the Board of Governors each woman proceeding to a Bachelor's degree must take Physical Education during the first year of her attendance at the University. Before October 2nd in the session in which Physical Education is compulsory, she must register at the gymnasium office, 153 Bloor Street West, and before October 15th apply for a medical examination by the University Health Service at 43 St. George Street. Swimming classes are compulsory for all students who do not pass the required swimming test. This test must be taken by October 22nd. Students of all years who wish to take part in any form of athletics or physical exercise must first undergo a medical examination by the Health Service.

The student who has failed to complete satisfactorily attendance at the required Physical Education classes prescribed for the first year will not be permitted to register in the third year. The student who has failed to complete satisfactorily attendance at the required Physical Education classes prescribed for the second year will not be permitted to register in the fourth year.

The student who has neglected to complete satisfactorily attendance at the required Physical Education classes for the first or second year must take this work during the second or third year respectively of his attendance at the University, and will be required to pay an additional supplemental fee of $10.00.

SECTION XV. HART HOUSE

Hart House, the gift of the Massey Foundation, is so called in memory of Mr. Hart Massey. This House, which is for the use of men only, is far more than a students' club. In its widest interpretation it seeks to provide for all the activities in the undergraduate's life apart from the actual work in the lecture room.

Hart House contains under one roof a dining hall, together with a shop where light refreshments are served, common-rooms, library, debates room, music room, a small chapel together with rooms for the use of the Student Christian Movement, an art gallery, photographic rooms, gymnasia, swimming pool, running track, rifle range, and theatre.

The House is open from 8 a.m. to 11 p.m. daily. Meals are served to students in the Great Hall from Monday to Saturday lunch. Members are entitled to full privileges of all rooms in the building between these hours and the use of the gymnasia, pool, showers and locker rooms until 9 p.m. each day except Saturday and Sunday, subject to the regulations of the Athletic Association. On Saturday the pool, together with the rest of the athletic wing, closes at 5 p.m.

The Warden is entrusted with the general supervision of the whole House, but the athletic wing is under the direct control of the Athletic Directorate. In great measure the care of the House and its welfare are entrusted to the students themselves. There are a number of committees, most of which consist of ten undergraduates, three senior members, and the Warden. The undergraduates on all these committees are elected annually by the undergraduate members of Hart House. The undergraduate secretaries of seven of these (House, Library, Music, Art, Camera, Debates, and Squash) together with certain appointed representatives, sit on the Board of Stewards, the governing board of the House, which is directly responsible to the Governors of the University. Of this Board the Warden is ex-officio chairman. The Comptroller, the Assistant Comptroller, the Graduate Secretary, and the Assistant to the Warden of Hart House are responsible for the administration.

All men undergraduates proceeding to a degree in the University are members of Hart House. The annual fee (September to May) is $12.00. To prevent the use of the building by unauthorized persons every member should carry his registration card and show it on request. Any member wishing to introduce a guest should obtain a card from the Warden's office.

Occasional students are not ordinarily eligible for membership in Hart House, but may make application to the Graduate Secretary's office for election by the Membership Committee.

Graduate students, graduates of this university resident in Toronto, and out of town graduates are entitled to the full privileges of Hart House when they have been duly elected and have paid the annual fee.

HART HOUSE THEATRE

Hart House Theatre is under the direct administration of the University of Toronto.

Control of the Theatre is vested in a Board of Syndics appointed by the Board of Governors. The purpose of the Theatre is the encouragement of Dramatic Art in all its aspects, particularly among the undergraduates of the University. The Theatre has a resident director and competent staff who are available for consultation and assistance. Their main activity is the production of a series of plays with all-student casts.

The Theatre was founded by the generosity of the trustees of the Massey Foundation, particularly the Right Honourable Vincent Massey and Mrs. Massey. Under the Massey Foundation and with the assistance of outstanding directors the Theatre has established an enviable reputation in Little Theatre activity throughout North America.

THE SOLDIERS' TOWER

To commemorate the sacrifice of those graduates and undergraduates of our University who gave their lives in the Great War (1914-1918), the graduates have erected the Soldiers' Tower. Situated at the southwest corner of Hart House, the Tower rises—a symbol of sacrifice—and with its screen forms a majestic link between Hart House and the old Main Building. Beneath the sheltering arches of the screen, the names of the six hundred and eighteen, to whom the memorial pays its proud and affectionate tribute, are cut deep in the stone. Above, in the belfry of the Tower, is a carillon that, as it chimes, weaves a fabric of memories for professors and students who take up the tasks laid down by those who fell.

HART HOUSE AJAX

Like its namesake, Hart House Ajax seeks to provide for the many activities in the undergraduate's life which lie outside the lecture room and laboratory. The main building, situated south of York Hall, contains a large common room, music room, record room and a shop where snacks are available. The common room serves also as an art gallery and the record room is used by members for playing the collection of fine recordings owned by Hart House Ajax. In three other buildings in close proximity to the student residences are facilities for drama, a Camera Club, Hobby Club, Amateur Radio Club (VE3BPD), motion pictures, dancing and five-pin bowling. From this it will be observed that Hart House Ajax is not one building but really a collection of buildings in which every effort is made to embody the Hart House "idea".

The small chapel, which is available for use by all members, is under the direction of the Rev. Carl Swan whose room is adjacent to the chapel. The library, which is for leisure reading, contains a wide selection of books of general interest. The books in this room must not be removed. Those wishing to take books to their rooms are referred to the Circulating Library

maintained by the University for Ajax students. Musical activities, consisting in the main of recitals given by outstanding artists on alternate Thursday evenings, and "Record Hours" at regular periods have become well established at Hart House Ajax. There is also a Hart House Ajax Glee Club which is under the direction of Mr. C. E. Olive. The club is comprised of undergraduates and staff who sing for their own enjoyment. All members of Hart House Ajax are invited to participate. Students interested in the Drama Club are advised to consult Mr. H. V. Brock who is responsible for this activity at Ajax. Camera Club rooms, provided with necessary equipment, are open to members of Hart House Ajax on payment of a fee to cover the expense of chemicals. A small deposit, in addition, is taken for door and locker keys. The Hobby Club, Amateur Radio Club and Chess Club are open to members of Hart House Ajax on the same basis.

All undergraduates enrolled in the Ajax Division are members of Hart House Ajax and, through the courtesy of the Board of Stewards, an invitation has been extended for male members of Hart House Ajax to make full use of the facilities of Hart House when in Toronto.

The Supervisor of Hart House Ajax is responsible for its general supervision, but in great measure the care of Hart House Ajax and its welfare is entrusted to the students themselves through the various Hart House Ajax committees. These committees are comprised mainly of undergraduates who are elected by the undergraduate members, and on each committee two senior members also serve. The administrative staff of Hart House Ajax consists of Mr. D. L. Emond, Supervisor, Mr. R. H. Loken, Assistant Supervisor, and Mr. H. V. Brock, Assistant in the Supervisor's Office.

SECTION XVI. STUDENT ORGANIZATIONS

STUDENTS' ADMINISTRATIVE COUNCIL

The Students' Administrative Council is composed of the Presidents or elected heads of the official undergraduate organizations of each college and faculty of the university, including Ajax. The Students' Administrative Council publishes *The Varsity*, *Torontonensis* and the *Students' Handbook*. It represents the students at university functions and on public occasions and receives and administers all funds accruing from Students' Council fees, revenues from publications, and such other funds as shall become the property of the Council, and through its Secretaries it organizes such intercollegiate and university activities as may be of interest to the student body as a whole.

The Council operates an employment bureau for men and women undergraduates for summer, Christmas and part-time work. It operates a housing service for men and women undergraduates and a loan fund for men and women undergraduates in the final two years of their courses. Application for loans must be made to the General Secretary-Treasurer. of the Students' Administrative Council. The maximum loan is $100.00. A short-term emergency loan fund is available to ex-service personnel pending receipt of maintenance grants or war service gratuities.

The sale of official university jewellery, crests, and so forth, and orders for official blazers are looked after by the Council.

The Council office is located in Hart House, the Women's Office is located in room 82, University College, and a Students' Council office is maintained at Ajax, located in Ajax Hart House, which provides all Council services for Ajax students. The annual fee paid by all undergraduates proceeding to a degree provides for a subscription to the publications of the Council to which the student is entitled and makes available to them all the services of the Council, including the loan fund. The fee also covers the administration costs of the Students' Administrative Council.

The Students' Administrative Council is prepared to make to ex-service personnel emergency loans pending receipt of their entitlements under the Educational Benefits provided in the Post-discharge Re-establishment Order.

UNIVERSITY OF TORONTO ATHLETIC ASSOCIATION

By the authority of the Board of Governors University athletics for men are under the control of the University of Toronto Athletic Association of which the executive body is the Athletic Directorate consisting of:

the President of the University,
two members of the faculty, appointed by the President,
two graduates, appointed by the Athletic Advisory Board,

the Director of University Health Service, the Director of Athletics and the Financial Secretary (*ex-officio*),
five undergraduates, elected annually, from the student body,
an undergraduate representative, appointed by the Men Students' Administrative Council.

Under the authority of the Board of Governors the Athletic Directorate shall have full control of the administration of the funds of the Association, which are used in furthering the development of competitive and recreational athletics for University students.

The Directorate subject to the approval of the President is empowered by the Board of Governors to control and administer the compulsory Physical Education programme required by the Board of all men undergraduates during the first and second years of their attendance. The Directorate shall also control and administer the voluntary programme in Athletics and Physical Education available to men undergraduates of all years.

The Directorate alone has the power to sanction the use of the name "The University of Toronto" in connection with men's athletics, and no men's athletic event can be held in the University without its approval. It has full control and direction of the gymnasium, the swimming pool, the locker rooms, showers and other conveniences in connection with athletics in Hart House, the athletic fields, stadium and ice arena.

The Supervisor of Athletics and Recreation, Ajax Division, subject to the approval of the Athletic Directorate, is empowered to establish and administer a fully developed programme of athletic activities for students attending the Ajax Division.

The annual athletic fee which is included in the incidental fees provides the same privileges for Ajax students as is available to students on the Toronto campus, subject to the limitations imposed as a result of inadequate facilities.

UNIVERSITY OF TORONTO WOMEN'S ATHLETIC ASSOCIATION

By the authority of the Board of Governors University athletics for women are under the control of the University of Toronto Women's Athletic Association of which the executive body is the Women's Athletic Directorate consisting of:

the President of the University,
two women members of the faculty, appointed by the President,
the Assistant Director of University Health Service in charge of Women, the Director of Physical Education for Women, and the Financial Secretary (*ex-officio*),
six women undergraduates, elected annually,
one woman undergraduate, appointed by the Students' Administrative Council.

The Directorate, subject to the approval of the President and the Physical Director for Women, is empowered by the Board of Governors to control and administer the compulsory Physical Education programme required by the Board of certain women undergraduates during the first year of their attendance. The Directorate also controls and administers the voluntary programme in Athletics and Physicial Education available to women undergraduates of all years.

The Directorate alone has the power to sanction the use of the name "The University of Toronto" in connection with women's athletics, and no athletic event for women may be held in the University without its approval.

Under the authority of the Board of Governors, the Women's Athletic Directorate administers the funds of the Association which are used to further the development of competitive and recreational athletics for undergraduate women.

UNIVERSITY OF TORONTO ENGINEERING SOCIETY

The Engineering Society of the University of Toronto, being inaugurated in 1885, is the oldest undergraduate Engineering Society in Canada. Every student enrolled in the Faculty of Applied Science and Engineering is a member.

As set forth in its Constitution the objectives of the Engineering Society are:

(*a*) The encouragement of original research in Engineering.
(*b*) The preservation of the results of such research.
(*c*) The dissemination of these results among its members.
(*d*) The cultivation of the spirit of mutual assistance and cooperation among the members of the Society in the preparation for, and in the practice of, the Profession of Engineering.
(*e*) To afford an official means of communication between the student-body and the Faculty Council, the University authorities, and the students of other Faculties.

The Engineering Society consists for purposes of organization of a Federation of Clubs which may be listed as follows:

(*a*) The Civil Club of the Engineering Society, composed of the undergraduates in Civil Engineering.
(*b*) The Mining and Metallurgical Club of the Engineering Society, composed of the undergraduates in Mining Engineering, Metallurgical Engineering and Mining Geology.
(*c*) The Mechanical Club of the Engineering Society, composed of the undergraduates in Mechanical Engineering.
(*d*) The Electrical Club of the Engineering Society, composed of the undergraduates in Electrical Engineering.
(*e*) The Architectural Club of the Engineering Society, composed of the undergraduates in Architecture.

(*f*) The Industrial Chemical Club of the Engineering Society composed of the undergraduates in Chemical Engineering.

(*g*) The Engineering Physics Club of the Engineering Society, composed of the undergraduates in Engineering Physics.

(*h*) The Aeronautical Club of the Engineering Society, composed of the undergraduates in Aeronautical Engineering.

(*i*) The Engineering and Business Club of the Engineering Society, composed of the undergraduates in Engineering and Business.

(*j*) The Debating Club of the Engineering Society, composed of the undergraduates in all departments.

These clubs devote themselves to subjects of special interest to their members. Each club holds meetings at regular intervals when papers are read and discussions of a technical nature take place. The club members have the privilege of listening to prominent men in their field and also making frequent field trips to industrial plants.

"Transactions and Year Book" is the official Society publication covering the year's activities. The "Toike Oike Quarterly" is the literary publication of the Society.

The Society also maintains a Supply Department which carries all student supplies with the exception of text books. Profits from the store are used to subsidize the Engineering Society's social functions.

FACULTY OF APPLIED SCIENCE ATHLETIC ASSOCIATION

Affiliated with the Engineering Society is the Faculty of Applied Science Athletic Association.

The Athletic Association has full control over all athletic clubs using the name of the Faculty of Applied Science. The Executive Committee has power to suspend anyone from the privileges of membership in the Association for any breach of its regulations, and controls the finances of all athletic clubs in the aforesaid Faculty. The annual membership fee of this Association is two dollars.

No other moneys are collected for the support of athletics in the Faculty of Applied Science without the sanction of the Executive Committee.

STUDENT CHRISTIAN MOVEMENT

The Student Christian Movement in the University of Toronto is part of an international fellowship of students in the colleges and universities of the world, the World's Student Christian Federation. Based on the conviction that in Jesus Christ are to be found the supreme revelation of God and the means to the full realization of life, the Movement seeks through a programme of study, prayer and practice to understand the Christian faith and to live the Christian life by uniting in its fellowship all students who share its basic convictions as well as those who wish to test their truth.

Among the methods employed by the Movement in seeking to realize its purpose are study groups, worship services, forum discussions, conferences, lectures, work projects, and social services. Of special interest to Engineering students are the "Student-in-Industry" camps which are carried on during the summer vacation periods in industrial communities.

The programme is open to all interested students. It is not necessary to "join" in order to share in the activities of the Movement. On the Toronto campus full information may be obtained from S.C.M. executive members in the various colleges, the names of whom will be found in the *Students' Handbook*, or from the S.C.M. offices in Hart House and the Household Science Building. Students at Ajax are invited to make the acquaintance of the resident chaplain, the Rev. L. Carl Swan, in Hart House Ajax and to participate in the life and work of the university community church which is under his direction.

VARSITY CHRISTIAN FELLOWSHIP

The Engineering Branch of the Varsity Christian Fellowship is affiliated with the campus-wide Varsity Christian Fellowship which in turn is a part of the world-wide Inter-Varsity Christian Fellowship.

The Fellowship is founded on the historic fact that God has revealed Himself in the life, death, and resurrection of His Son, Jesus Christ; that personal faith in Him results in the forgiveness of sin, victory over sin, and a new joyful life purpose. The Fellowship is seeking to bear witness to the vitality of this faith and to the power of the Saviour in every relationship of life.

Through the activities, which are open to all undergraduates, it seeks to show the applicability of these principles to an individual in business or professional life.

These activities embrace (*a*) daily prayer meetings at 8.15 a.m. in Hart House Chapel, (*b*) weekly noon-hour meetings on Tuesdays and (*c*) special events such as dinners, firesides, and sing songs. The officers are listed in the *Students' Handbook* and announcements are made in the *Varsity.*

THE JOINT HOUSE COMMITTEE AJAX DIVISION RESIDENCES

The Joint House Committee, composed of the elected student Chairman from each residence, undertakes to regulate the residence life of the students. Its major duties and responsibilities are:

1. To promote, co-ordinate and direct the domestic and social activities of the residences.
2. To encourage the athletic activities of the students in residence.
3. To bring to the attention of the proper authorities any matter which concerns the welfare of the students in residence.

4. To hold an investigation into any matter involving one or more houses, and to impose penalties; or make recommendations to the Residence Committee, where necessary.
5. To recommend to the Residence Committee that fines and/or penalties be imposed on any individual or group of individuals or on a specific residence, if such action seems warranted.

The Joint Committee elects from its own number an executive committee composed of a Chairman, Vice-Chairman, Secretary-Treasurer, Social representative and a Member. One of this number acts as a liaison member between the Joint House Committee and the Food Service Department, and another acts as a liaison member between the Joint House Committee and the "Varsity".

UNIVERSITY OF TORONTO

UNIVERSITY NAVAL TRAINING DIVISION

The University Naval Training Division (UNTD) was formed in the spring of 1943 by Naval Service Headquarters, the primary purpose being to prepare students for eventual active service with the Royal Canadian Navy during hostilities. The peacetime purpose of the UNTD is to keep students interested in the Royal Canadian Navy and to qualify them as potential officer material for commissions in either the Permanent Navy or the Naval Reserve.

Unlike men of the Royal Canadian Navy who are enlisted for five years' service, students in the UNTD are attested on the Active List of the Royal Canadian Navy (Reserve).

Students in the UNTD, University of Toronto, are part of the complement of H.M.C.S. "York", and their administration, training, and discipline are under the jurisdiction of the Commanding Officer, H.M.C.S. "York".

While enrolled in the UNTD students wear uniforms similar to those of seamen in the R.C.N. Students may wear uniforms only on parade nights.

Students entering the UNTD are attested as Ordinary Seamen unless their academic field is allied to a branch of the Navy in which they might become commissioned. In such cases students are entered in the lowest rating of the branch concerned, e.g.:

(a) Students in Mechanical Engineering as Stokers Second Class.
(b) Students in Electrical Engineering as Electrician's Mates Second Class.
(c) Students in Commerce and Finance and Law as Probationary Writers.
(d) Students in Medicine as Probationary Sick Berth Attendants.

UNTD ratings are given a minimum of sixty hours' training during the academic year and two weeks' naval training with substantial rates of

pay at the Coast during the summer months. The syllabus of training is progressive from year to year and covers basic training courses with advanced courses in the third and fourth years.

The Ship's Office of the UNTD is located at 119 St. George Street, telephone MIdway 9837.

Area Commanding Officer................Captain F. R. Base, RCN(R)
Commanding Officer..............Lieutenant-Commander R. F. McRae, RCN(R)

UNIVERSITY OF TORONTO CONTINGENT CANADIAN OFFICERS TRAINING CORPS

In view of the record of the officers who received their training in the COTC before and during the war, the Director of Military Training at Canadian Army Headquarters has stated that this Corps is now looked upon as the chief source of officers for the Canadian Army.

A student who completes his training in the COTC is granted a commission as a lieutenant in the Canadian Army upon graduation and may join the Active Force (permanent army), if vacancies are available, or the Reserve Force. He is, however, under no obligation to do so but may remain on the Supplementary Reserve (inactive list).

Training is organized into two portions:

(a) Practical training, twelve to sixteen weeks each summer at Active Force Schools.

(b) Theoretical training, lecture courses during two academic sessions; not more than forty lectures per year.

Pay during the summer is $143 per month, and for those completing each theoretical lecture course, an additional ten days' pay. During summer training, board, lodging, clothing and transportation from the University to Corps Schools and return, is all provided free of charge.

To be eligible, students must be between eighteen and twenty-two years of age, British subjects, physically fit, and following a course of study leading to a University degree. Exceptions as to age are made in cases where a student was in one of the services during the war.

Arrangements have been made so that summer training may be accepted in part for the summer practical work required in certain faculties and courses.

Application for training should be made in person before the 15th of October to Contingent Headquarters, 119 St. George Street, Toronto. Previous experience has been that many more applications are received than can be accepted. Ajax students may apply at a time and place to be posted on the first of October on the notice board at Hart House (Ajax).

The Contingent Staff is:

Honorary Colonel	Colonel H. J. Cody, C.M.G., E.D.
Commanding Officer	Lieutenant-Colonel W. L. Sagar
Second-in-Command	Major L. S. Lauchland, E.D.
Adjutant	Captain J. H. Potts
Resident Staff Officer	Major H. W. F. Appleton, E.D., s.c.
Assistant Resident Staff Officer	Major G. MacLean Logan, p.s.c.

UNIVERSITY ADVISORY BUREAU

Under authority of the Board of Governors of the University, an Advisory Bureau for Ex-Service Students has been operating at the University since 1945. Designed to assist students in their adjustment to university life, the Bureau seeks to aid by performing certain definite functions:

(a) Through liaison with the University departments, the Registrars' offices and appropriate services on the campus, the Bureau furnishes information and assistance in the financial, educational and personal spheres. The Bureau, for instance, serves as a focal centre for applications to The Veteran-Students' Loan Fund and provides information on other loan facilities, including Navy, Army and Air Force Benevolent Trust Funds. Working with appropriate Registrars' offices, the Bureau helps the student to clarify details regarding entrance requirements, courses of study and related occupational goals. The Bureau is also available for consultation on personal questions involving adjustment to University life, assessment of interests, vocational direction and other matters of a similar nature; where advisable, students are referred to more specialized services.

(b) Liaison with D.V.A. The Bureau works closely with the Department of Veterans Affairs, both locally and with Ottawa headquarters, on all matters affecting the interests of ex-service students and in many ways serves as a campus clearing house for problems which might otherwise require to be referred to the Toronto office of D.V.A. During the past two years an authorized officer of D.V.A. has maintained office space in the Bureau and has been of invaluable assistance in clearing locally problems falling within the province of his department.

(c) Liaison with other universities. In contact with the Advisory Bureaus located at other Universities across Canada, the Bureau seeks to maintain up-to-date information on local variations in all fields significant to ex-service students—entrance requirements and application deadlines, courses available, length of training, degrees awarded, etc.

The personnel consultants associated with the Bureau have for the most part seen service in the late war and have been associated with the Personnel or Rehabilitation Directorates of the Navy, Army or Air Force.

The Bureau serves the Queen's Park campus through its office at 67 St. George Street, and the Ajax campus through its office in Hart House, Ajax.

SECTION XVII. LODGING AND BOARD

Housing Service for Students

For students who are not accommodated in the University and College residences, the Students' Administrative Council prepares annually a list of inspected and approved rooming houses, flats, apartments and homes. This list may be consulted at the Housing office in Hart House after August 1st and throughout the session.

To meet the housing shortage in Toronto, the Students' Administrative Council has greatly expanded its Housing Service. Every effort is being made to provide accommodation for married ex-service students. Information may be obtained from the Students' Administrative Council's Housing Service office, Hart House.

Through this service many opportunities have been afforded students, including those students who are married to obtain lodging and board in exchange for part-time services. Students desiring this type of accommodation are asked to indicate this when they apply.

RESIDENCE FOR MEN

Through the generosity of the late E. C. Whitney, Esq., Mrs. Whitney, and friends, the University offers to approximately two hundred men the advantages of residential life within its own grounds. The Residence consists of three Houses: South, East and North.

The regular rates are $4.75 a week. Occupants are required to pay their residence dues in two instalments, the first instalment, for the Michaelmas term, on entrance and the second instalment, for the Easter term, in January.

Except under very special circumstances, occupants will be required to remain in the Residence for the full academic session. Occupants who obtain permission to withdraw will be required to give two weeks' notice and to forfeit their deposits.

Applications for rooms must be submitted to the Secretary of the Residence Committee, Registrar's Office, Simcoe Hall. Forms for this purpose will be supplied on request. As early as possible the summer preceding attendance at the University, each successful applicant will be notified of his assignment. He must then send to the Secretary of the Residence Committee a deposit of $5.00. On receipt of this he will be sent an assignment card. Cheques or money orders must be made payable to the University of Toronto. The deposit will be returned if the applicant is not admitted, but will be forfeited if written notice of non-acceptance of a room assigned is not received by the Secretary before September 15th. If such notification is not received until after the opening of the session, the applicant will forfeit his deposit and will be required to pay a penalty of two weeks' room rent. On request the deposit will be refunded in full at the end of the college year if the room key is returned and the room and furniture left in a satisfactory condition.

The University lays down three general rules designed to prevent hazing, gambling, and the use of intoxicants.

A circular giving further information may be obtained from the Secretary of the Residence Committee.

AJAX DIVISION RESIDENCES

The residences at Ajax accommodate approximately 50 or 80 students each, depending on the type of building. All residences are equipped with study rooms, kitchenette, common room, telephone and other facilities. Students are accommodated two to a room.

The charge for room and board for the session will be approximately $270.00.* It should be noted, however, that:

(a) Meals included in the above rate are from Monday to Friday, inclusive.

(b) Saturday and Sunday meals are on a cash basis.

(c) Meals during vacation periods are not included in the above rate. Such meals are on a cash basis.

All meals are served in the University Cafeteria.

A student is required to remain in residence for the entire session. Permission to withdraw may be given by the Residence Committee, only in exceptional circumstances.

Students in residence are required to abide by the Residence Regulations (Ajax) laid down by the Residence Committee, and the three general University rules prohibiting hazing, gambling or the presence and use of intoxicants on University property.

Application forms for admission to residence may be obtained from the Registrar's Office, Simcoe Hall, Toronto, or the Dean and Supervisor of Residences, Ajax Division, Ajax, Ontario. The completed application must be accompanied by a deposit of $5.00 which will be returned if the applicant is not admitted. The $5.00 deposit will be refunded at the end of the session, if the room key is returned, and the room and furniture left in a satisfactory condition.

The completed application together with the $5.00 deposit should be forwarded as early as possible to the Bursar's Office, Ajax Division, University of Toronto, Ajax, Ontario. Residence dues are also payable at the Bursar's Office, as above.

If a student, after making application, will not require his room, he should so inform the Dean and Supervisor of Residences as soon as this fact is known.

Enquiries concerning residences should be addressed to the Dean and Supervisor of Residences, Ajax Division.

*In view of the increasing costs of supplies and labour, residence dues are subject to change by the Board of Governors.

SUMMARY OF STUDENTS IN ATTENDANCE

Session 1947-48

	Course												
Year	1	2	3	4	5	6	7	8	8a	9	10	11	Total
I	179	52	243	94	65	158	210	33	8	48	53	65	1208
II	211	42	315	77	96	192	243	44	10	37	72	110	1449
III	177	52	262	83	88	173	238	32	11	50	60	99	1325
IV	74	12	118	17	49	73	87	18	7	3	23	37	518
V	...	...	...	9	...	...	...	...	..	...	...	...	9
	641	158	938	280	298	596	778	127	36	138	208	311	4509
							West Indies Surveyors						4
							Total						4513

For graduate students, see p. 232

SECTION XVIII. THE ENGINEERING ALUMNI ASSOCIATION

This calendar presents in outline the courses offered in the Faculty of Applied Science and Engineering, as well as an indication of opportunities which are open to undergraduates for a broadening of their interests by participation in the extra-curricular activities of the Faculty and University.

After spending a few years under the stimulating and maturing influence of college life it is natural that students should, after graduation, feel a desire to preserve the friendships formed in undergraduate days, and should seek to extend the opportunity for further interest and service on behalf of Faculty and Alma Mater.

Many Engineering graduates, who recall their college days with pleasure and a sense of indebtedness, have felt this desire which has found expression in the formation of the Engineering Alumni Association. With succeeding years of mellowing traditions and fresh infusions of new members annually, it has grown in enthusiasm as well as in size. Each graduating class appoints its own permanent executive, thus retaining its identity and through the inspiration and leadership of the Engineering Alumni Association all find a common bond of loyalty to "School" and its traditions, and a friendly contact with their fellows.

Every three years a reunion of "School" graduates is held to bring them together for a renewal of old associations with classmates and with staff. Between times the Association carries on its work through its Council. The extent of these activities is well exemplified by naming such council committees as Membership, Scholarship, Class Organizations, Undergraduate Relations, Engineering Education, Reunions, Publicity, and Federation Affairs. Certain members of the Council are constituted as a Junior Panel and maintain close relations with the more recent graduates, while the inclusion of the President of the Engineering Society on the Council ensures liaison with the undergraduate body.

The Engineering Alumni Association serves in the wider sphere of University graduate activities through its membership in the Alumni Federation of the University of Toronto, which was formed from seventeen associations representing various Colleges, Faculties, and Departments in the University. The Federation co-ordinates the activity of all the Associations and edits and publishes the *University of Toronto Monthly*, which contains news items and articles of interest to all graduates. Through Class, Association and Federation the bond is complete and "School" men take pride in the extent to which they have contributed of their counsel and support on such matters as the University and the Faculty may wish to consult the graduate body.

All "School" graduates, and students who have had at least one year in the Faculty of Applied Science and Engineering, are members of the

Engineering Alumni Association and the Alumni Federation; but only those paying the prescribed annual fee of three dollars are entitled to vote, hold office, or exercise the rights and privileges of membership and to receive the *University of Toronto Monthly.* This fee is distributed—one dollar to the Engineering Alumni Association for the maintenance of its activities, and two dollars to the Alumni Federation towards a share of its administrative expenses and for clerical work on behalf of the Association, and to cover the members' subscription to the *University of Toronto Monthly.*

APPENDIX I. GRADUATE STUDIES

Graduates interested in pursuing courses for post-graduate degrees should send inquiries to the Secretary of the School of Graduate Studies.

The University is prepared to offer graduate courses in all of the Departments of the Faculty of Applied Science and Engineering. The degrees offered are M.A.Sc., M.Arch., and Ph.D. These courses are open to graduates of this University or of another University of comparable standing. Candidates must have a sufficiently good undergraduate record in a course closely related to the one they propose to follow.

Various Fellowships, Bursaries, and Scholarships are available to graduate students as shown in the table on page 164. In time of peace many part-time demonstratorships are open which permit graduate work towards a degree. In normal times, also, research assistants are appointed annually on salary in the School of Engineering Research, and this work may be counted as a partial fulfilment of the requirements for a graduate degree.

One full academic year of study is required for the degree of M.A.Sc. and M.Arch. and a minimum of three years for the degree of Ph.D. Part-time work must total to these full-time requirements. To be eligible to receive the degree of Ph.D. the candidate must make an original contribution to knowledge.

REGULATIONS FOR DEGREES

MASTER OF APPLIED SCIENCE, MASTER OF ARCHITECTURE

The regulations governing the Degrees of Master of Applied Science (M.A.Sc.) and Master of Architecture (M.Arch.) shall be determined as follows:

1*a*. A candidate for the degree of Master of Applied Science shall hold the degree of Bachelor of Applied Science of this University or a degree from some other university recognized as equivalent by the Council of th School of Graduate Studies.

1*b*. A candidate for the degree of Master of Architecture shall hold the degree of Bachelor of Architecture or the degree of Bachelor of Applied Science in Architecture of this University or a degree from some other university recognized as equivalent by the Council of the School of Graduate Studies.

2. A candidate wishing to proceed to a graduate degree shall (*a*) register with the Secretary of the School of Graduate Studies at the beginning of the academic year, (*b*) enrol in one of the courses mentioned in Clause 4. As a condition of registration as a candidate proceeding to a degree, he must submit evidence that the department concerned is willing to enrol him.

3. Not later than November 1, 1948, he shall submit to the Secretary

for acceptance by the Council of the School of Graduate Studies the title of his proposed thesis as approved by the department concerned.

4. Not later than May 15, 1949, he shall present evidence to the Council of the School of Graduate Studies that he has spent not less than one academic year in the course concerned as a student enrolled in one of the following courses on a course of study approved by the department: Civil Engineering, Mining Engineering, Mechanical Engineering, Architecture, Engineering Physics, Chemical Engineering, Electrical Engineering, Metallurgical Engineering, Mining Geology, Aeronautical Engineering.

5. Not later than May 15, 1949, evidence that the candidate has satisfactorily met all the requirements of the department with regard to thesis and to such examinations as the department shall require, shall be forwarded to the Council of the School of Graduate Studies through the sub-committee administering the regulations governing the degrees of Master of Applied Science and Master of Architecture.

DOCTOR OF PHILOSOPHY

Graduates of the Faculty of Applied Science and Engineering may proceed to the degree of Doctor of Philosophy. Information as to the conditions to be met by candidates for this degree is to be found in the Calendar of the School of Graduate Studies, which may be obtained from the Registrar of the University. The degree is an academic degree, not a professional one, and the research work and courses leading to the degree are primarily concerned with the fundamentals and underlying principles of the sciences. In general, a candidate selects one major and two minor subjects for study, the research being carried out in the major subject. A period of three years is usually required for the fulfilment of the requirements for the degree. However, it should be understood that the degree is not granted for the passing of prescribed courses or for the performance of prescribed laboratory work for a period of three years. The laboratory research work must have led to results of a high order, constituting a real contribution to the science of the major subject, and the candidate must have attained a decided maturity of knowledge and outlook before he may present himself for final examination by the Committee of the School of Graduate Studies. A graduate proposing to proceed to this degree should consult, in the first instance, with the members of the staff in the department in which he proposes to take his major subject.

PROFESSIONAL DEGREES

CIVIL ENGINEER, MINING ENGINEER, MECHANICAL ENGINEER, ELECTRICAL ENGINEER, CHEMICAL ENGINEER, METALLURGICAL ENGINEER

The regulations governing the Professional Degrees of Civil Engineer (C.E.), Mining Engineer (M.E.), Mechanical Engineer (Mech.E.), Elec-

trical Engineer (E.E.), Chemical Engineer (Chem.E.), Metallurgical Engineer (Met.E.), for the session 1948-49 shall be determined as follows:

1. A candidate for one of the said degrees shall hold the diploma of the School of Practical Science or of the Faculty of Applied Science and Engineering or the degree of Bachelor of Applied Science, or shall have spent not less than two years as a member of the teaching staff in this Faculty after having graduated in engineering from another institution of recognized reputation.

2. He shall have spent at least three years after receiving the diploma or the degree in the actual practice of the branch of engineering wherein he is a candidate for a degree.

3. Intervals of non-employment, or of employment in other branches of engineering, shall not be included in the above three years. It shall not be necessary that the several periods requisite to make up the said three years be consecutive.

4. The candidate shall obtain from the Secretary of the School of Graduate Studies the regular application form which, properly filled out, accompanied by the designated evidence of professional experience and by the title and synopsis of the proposed thesis, shall be delivered to the Secretary not later than the first day of November.

The evidence of professional experience shall fully describe the kind and extent of all work undertaken by the candidate since the date of graduation up to the time of application, indicating clearly the degree of responsibility for such work. Certificates from present and past employers shall accompany the application. The names and addresses of not less than five engineers to whom the candidate is personally known and who have knowledge of his professional activities shall be submitted.

5. The application and the subject of the thesis are subject to the approval of the Board of Examiners, who may satisfy themselves by oral or written examinations in regard to the candidate's experience and competence in engineering works.

6. The candidate after notification of the approval of the Board shall prepare an original engineering thesis in the branch in which he has applied for a degree. This thesis shall be on work in which the candidate has had actual experience and shall preferably be in the form of an engineer's report on the design of engineering works, or on processes, and accompanied by all necessary descriptions, details, drawings, bills of materials, specifications and estimates. (Note that a thesis of a solely descriptive type will not be acceptable.)

7. The thesis, with accompanying papers, described in clause 6, shall be sent to the Secretary not later than the first day of March.

8. The candidate may be required to present himself for examination in the months of March or April at such time as may be arranged by the Examiners.

9. The thesis, drawings and other papers submitted under clause 7, shall become the property of the University.

10. Nothing in these regulations shall prevent any candidate from receiving more than one of the said degrees, provided he has the necessary qualifications for each degree. An interval of three years must elapse between the granting of any two degrees under these regulations.

HIGH SCHOOL ASSISTANTS' CERTIFICATES, TYPES A AND B

The Department of Education of Ontario has agreed to accept the degree of Bachelor of Applied Science as fulfilling the academic requirement for admission to the course for a High School Assistants' Certificate in the Ontario College of Education.

HIGH SCHOOL ASSISTANTS' CERTIFICATES, TYPE A

By an agreement between the University of Toronto and the Department of Education of Ontario, persons holding the degree of Bachelor of Applied Science may, by taking certain prescribed courses in the Faculty of Arts, complete the academic requirements for admission to the qualifying examination for courses leading to High School Assistants' Certificates, Type A, in (*a*) Mathematics and Physics and (*b*) Science, at the Ontario College of Education. Information regarding these prescribed courses may be obtained from a pamphlet issued by the Registrar of the University, from whom copies may be had on application. Each person who desires to complete these academic requirements should communicate directly with the Registrar in order that his case may be considered and his particular conditions defined.

The Department of Education has approved of the acceptance of the degree in Applied Science in the Course in Engineering Physics, with standing of at least 66% at the final examination, as covering the academic requirements for admission to the qualifying examination for the course leading to High School Assistants' Certificates, Type A, in Mathematics and Physics at the Ontario College of Education.

ONTARIO LAND SURVEYORS AND DOMINION LAND SURVEYORS

Examinations are held usually in February of each year, for the following:

Preliminary Dominion Land Surveyors
Leveller's Examination
Final Dominion Land Surveyors
Ontario Land Surveyors

Any student of the Faculty of Applied Science and Engineering is eligible for these examinations, but graduates in Civil and Mining Engineering are allowed a shortened apprenticeship before writing their final examinations. Full information respecting above examinations may be obtained from the staff in Surveying and Geodesy.

GRADUATES ENROLLED IN THE FACULTY OF APPLIED SCIENCE AND ENGINEERING

Civil Engineering	13
Mechanical Engineering	19
Engineering Physics	9
Chemical Engineering	16
Electrical Engineering	12
Metallurgical Engineering	7
Mining Geology	21
Aeronautical Engineering	9
Total	87

INDEX

Administrative Officers 7
Admission, Qualifications and Procedure for 26
Advisory Bureau 222
Aerodynamic Laboratory 201
Aeronautical Engineering 33, 78, 84
Ajax Division Libraries 192
Alternating Current Machine Laboratory 197
Alumni Association 226
Annual Examinations 158
Applied Mathematics 142
Applied Mechanics 86
Applied Physics 92
Applied Physics Laboratories 199
Architecture 95
Architecture, School of 33, 49
Assaying 103
Assaying Laboratory 194
Astronomy 107
Athletic Association 215, 216, 218
Attendance, Summary of Students in 225, 232

Bachelor Degrees 33
Botany 107
Bursaries 160
Business Administration 115

Calendar 5
Canadian Officers' Training Corps 221
Cement Laboratory 192
Ceramics and Non-Metallic Minerals 145
Ceramic Engineering 33, 71
Chemical Engineering 33, 60, 108
Chemical Engineering Laboratories 196
Chemistry 108
Civil Engineering 33, 38, 108
Civil Engineering Laboratories 192
Commencement 6
Communication Laboratory 197
Communication 55, 57
Conduct of Students 204
Constitution, Student Societies 215
Courses 33
Courses, Graduating 33, 38
Curriculum 36

Degrees 33
    Bachelor 33
    Master 34, 228
    Professional 34, 228
    Ph.D. 34, 228
Departmental Libraries 192
Department of Health Laboratory 201
Deposits 30
Descriptive Geometry 112
Design of Structures 86

Direct Current Machine Laboratory.......... 197
Discipline.......... 204
Dominion Land Surveyors.......... 231
Drawing.......... 112

Economics.......... 115
Electrical Engineering.......... 33, 64, 119
Electrical Engineering Laboratories.......... 196
Electrical Measurements Laboratory.......... 197
Electricity.......... 119
Electricity and Communication.......... 55, 57
Electrochemical Laboratories.......... 201
Engineering Alumni Association.......... 226
Engineering and Business.......... 33, 81
Engineering Problems and Drawing.......... 112
Engineering Physics.......... 33, 53
Engineering Research, School of.......... 35
Engineering Society.......... 217
English.......... 147
Examinations.......... 158
Excursions.......... 37
Ex-Service Personnel.......... 159, 222
Extra-Curricular Activities.......... 159

Fees.......... 30
Fluid Mechanics.......... 133

Geodesy.......... 107
Geological Laboratories.......... 202
Geology.......... 126
Geological Sciences.......... 126, 146
Geophysics.......... 55, 58
German.......... 148
Graduate Studies.......... 228
Graduating Courses.......... 33, 38

Hart House.......... 212
Hart House—Ajax.......... 213
Heat Engine Laboratory.......... 195
Heat Engines.......... 130
High School Assistants' Certificates.......... 231
Highway Laboratory.......... 193
Historical Sketch.......... 25
History.......... 115
Holidays.......... 5
Hydraulic Laboratory.......... 196
Hydraulics.......... 133

Illumination and Acoustics.......... 55, 59
Inquiries.......... 26, 35

Laboratories.......... 192
Languages.......... 147
Law.......... 115
Lecture and Laboratory Subjects.......... 84
Libraries.......... 191
Loan Funds.......... 160
Lodging and Board.......... 223

Machinery.......... 135
Masters Degrees.......... 228
Mathematics.......... 142
Mechanical Engineering..........33, 46
Mechanical Engineering Laboratories.......... 195
Mechanics.......... 86
Mechanics of Materials Laboratory.......... 193
Meetings, Engineering Society.......... 5
Medals.......... 160
Metallurgy.......... 142
Metallurgical Engineering..........33, 68
Metallurgical Engineering Laboratories.......... 198
Metrological Laboratory.......... 200
Mineralogical Laboratories.......... 202
Mineralogy.......... 146
Mining.......... 103
Mining Engineering..........33, 42
Mining Geology..........33, 74
Mining Engineering Laboratories.......... 194
Modern Languages.......... 147
Municipal Administration.......... 108
Museum, Royal Ontario.......... 203

Naval Training Division, University.......... 220
Non-Metallic Minerals.......... 145

Officers, Administrative.......... 7
Officers' Training Corps, Canadian.......... 221
Ontario Department of Health Laboratory.......... 201
Ontario Land Surveyors.......... 231
Ore Dressing.......... 103
Ore Dressing Laboratory.......... 195

Petrography.......... 146
Ph.D.......... 34
Photographic Laboratory.......... 199
Physical Education..........28, 148, 210
Physics, Applied.......... 92
Physics.......... 148
Practical Experience.......... 151
Professional Degrees..........34, 229
Prizes.......... 160

Refrigeration..........56, 59
Registration..........26, 28
Research Assistants.......... 35
Research, School of Engineering.......... 35
Residences.......... 223
Residences, Ajax.......... 224

School of Architecture.......... 33
School of Engineering Research.......... 35
School of Graduate Studies.......... 228
Scholarships.......... 160
Shop Work..........46, 152

Sickness....... 158
Soil Mechanics Laboratory....... 193
Soldiers' Tower....... 213
Specialists' Certificates....... 231
Spectroscopy.......55, 57
Staff, Teaching....... 8
Structures, Design of....... 86
Student Christian Movement....... 218
Students' Administrative Council....... 215
Student Organizations....... 215
Supplemental Examinations....... 159
Summary of Students in Attendance.......225, 232
Surveying....... 153
Survey Camp.......5, 155, 200

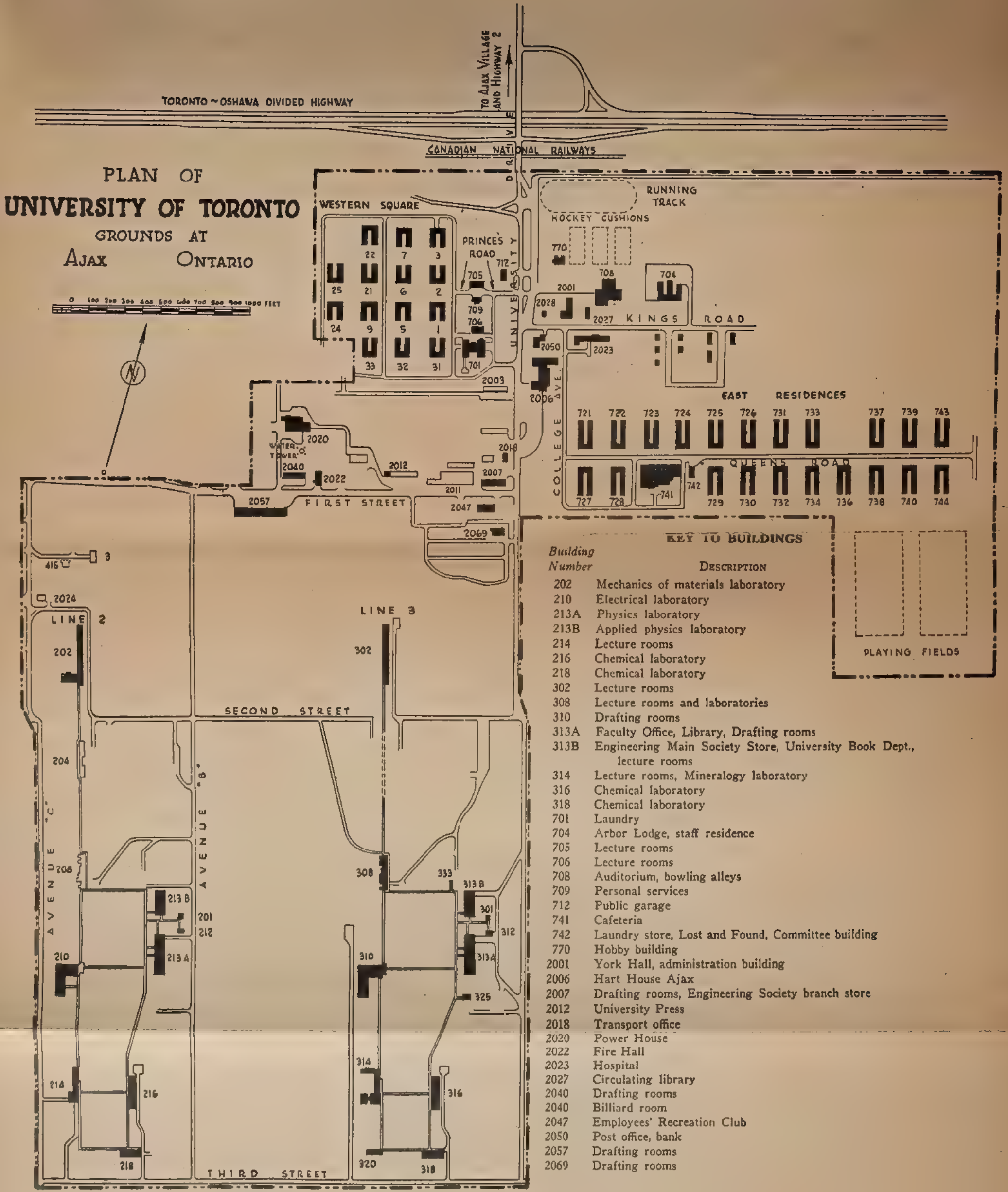
Teachers' Certificates....... 231
Term Examinations....... 159
Theatre, Hart House....... 213
Thesis....... 156

University Advisory Bureau....... 222
University Health Service....... 206
University Naval Training Division....... 220
University Survey Camp....... 5, 155, 200

Vaccination....... 28
Varsity Christian Fellowship....... 219

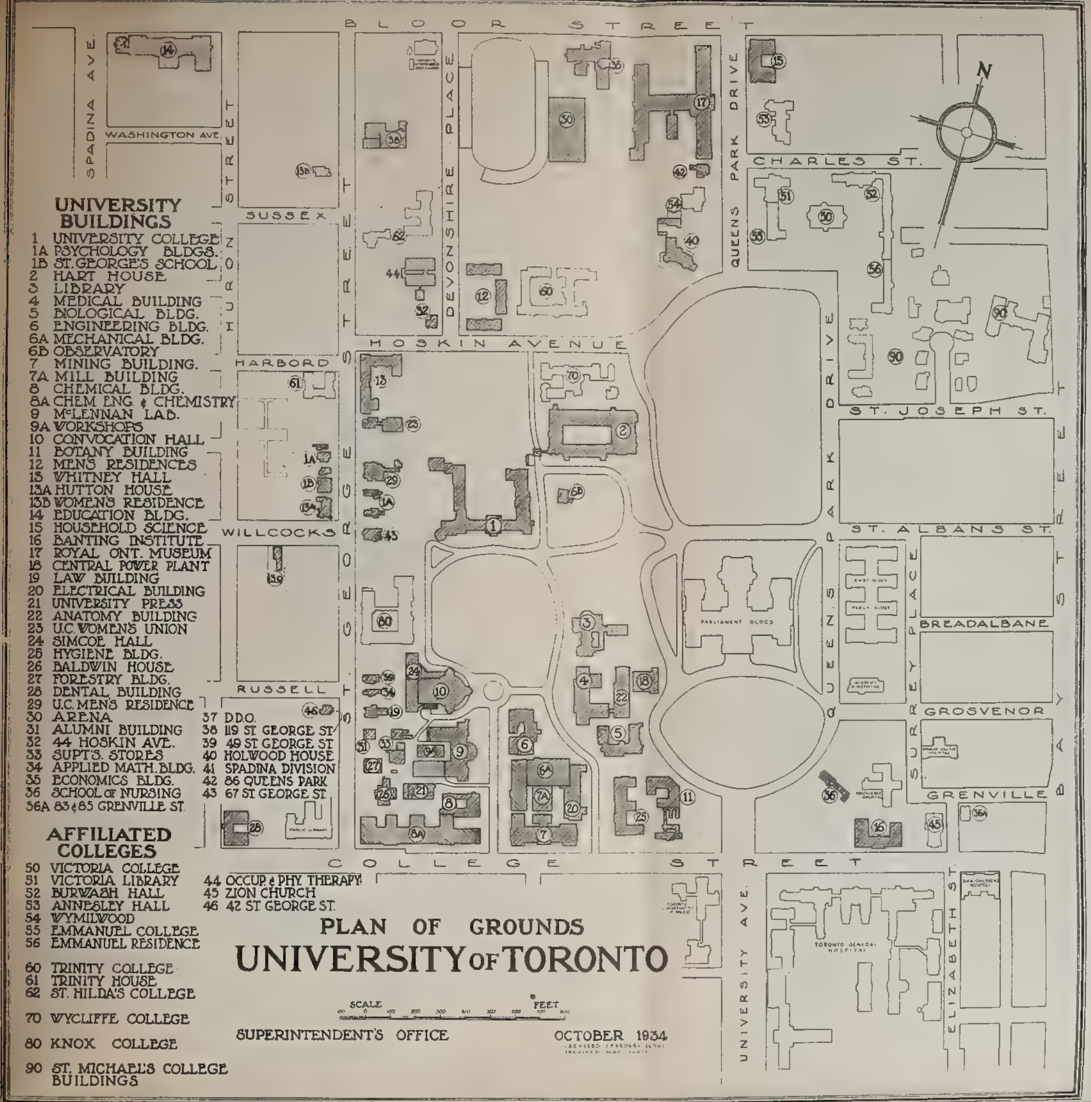
X-Rays and Spectroscopy.......51, 53

PLAN OF UNIVERSITY OF TORONTO GROUNDS AT AJAX ONTARIO



KEY TO BUILDINGS

Building Number	Description
202	Mechanics of materials laboratory
210	Electrical laboratory
213A	Physics laboratory
213B	Applied physics laboratory
214	Lecture rooms
216	Chemical laboratory
218	Chemical laboratory
302	Lecture rooms
308	Lecture rooms and laboratories
310	Drafting rooms
313A	Faculty Office, Library, Drafting rooms
313B	Engineering Main Society Store, University Book Dept., lecture rooms
314	Lecture rooms, Mineralogy laboratory
316	Chemical laboratory
318	Chemical laboratory
701	Laundry
704	Arbor Lodge, staff residence
705	Lecture rooms
706	Lecture rooms
708	Auditorium, bowling alleys
709	Personal services
712	Public garage
741	Cafeteria
742	Laundry store, Lost and Found, Committee building
770	Hobby building
2001	York Hall, administration building
2006	Hart House Ajax
2007	Drafting rooms, Engineering Society branch store
2012	University Press
2018	Transport office
2020	Power House
2022	Fire Hall
2023	Hospital
2027	Circulating library
2040	Drafting rooms
2040	Billiard room
2047	Employees' Recreation Club
2050	Post office, bank
2057	Drafting rooms
2069	Drafting rooms



PLAN OF GROUNDS
UNIVERSITY OF TORONTO
SUPERINTENDENT'S OFFICE
OCTOBER 1934
SCALE
FEET
N
UNIVERSITY BUILDINGS
1 UNIVERSITY COLLEGE
1A PSYCHOLOGY BLDGS.
1B ST. GEORGE'S SCHOOL
2 HART HOUSE
3 LIBRARY
4 MEDICAL BUILDING
5 BIOLOGICAL BLDG.
6 ENGINEERING BLDG.
6A MECHANICAL BLDG.
6B OBSERVATORY
7 MINING BUILDING.
7A MILL BUILDING
8 CHEMICAL BLDG.
8A CHEM. ENG. & CHEMISTRY
9 McLENNAN LAB.
9A WORKSHOPS
10 CONVOCATION HALL
11 BOTANY BUILDING
12 MEN'S RESIDENCES
13 WHITNEY HALL
13A HUTTON HOUSE
13B WOMEN'S RESIDENCE
14 EDUCATION BLDG.
15 HOUSEHOLD SCIENCE
16 BANTING INSTITUTE
17 ROYAL ONT. MUSEUM
18 CENTRAL POWER PLANT
19 LAW BUILDING
20 ELECTRICAL BUILDING
21 UNIVERSITY PRESS
22 ANATOMY BUILDING
23 U.C. WOMEN'S UNION
24 SIMCOE HALL
25 HYGIENE BLDG.
26 BALDWIN HOUSE
27 FORESTRY BLDG.
28 DENTAL BUILDING
29 U.C. MEN'S RESIDENCE
30 ARENA
31 ALUMNI BUILDING
32 44 HOSKIN AVE.
33 SUPT'S. STORES
34 APPLIED MATH. BLDG.
35 ECONOMICS BLDG.
36 SCHOOL OF NURSING
36A 83 & 85 GRENVILLE ST.
37 D.D.O.
38 119 ST. GEORGE ST.
39 49 ST. GEORGE ST.
40 HOLWOOD HOUSE
41 SPADINA DIVISION
42 86 QUEENS PARK
43 67 ST. GEORGE ST.
44 OCCUP. & PHY. THERAPY
45 ZION CHURCH
46 42 ST. GEORGE ST.
AFFILIATED COLLEGES
50 VICTORIA COLLEGE
51 VICTORIA LIBRARY
52 BURWASH HALL
53 ANNESLEY HALL
54 WYMILWOOD
55 EMMANUEL COLLEGE
56 EMMANUEL RESIDENCE
60 TRINITY COLLEGE
61 TRINITY HOUSE
62 ST. HILDA'S COLLEGE
70 WYCLIFFE COLLEGE
80 KNOX COLLEGE
90 ST. MICHAEL'S COLLEGE BUILDINGS
BLOOR STREET
COLLEGE STREET
SPADINA AVE.
WASHINGTON AVE.
HURON STREET
SUSSEX
HARBORD
WILLCOCKS
RUSSELL
ST. GEORGE STREET
DEVONSHIRE PLACE
HOSKIN AVENUE
QUEENS PARK DRIVE
CHARLES ST.
ST. JOSEPH ST.
ST. ALBANS ST.
BREADALBANE
GROSVENOR
GRENVILLE
BAY STREET
SURREY PLACE
QUEENS PARK
UNIVERSITY AVE.
ELIZABETH ST.
PARLIAMENT BLDGS.
TORONTO GENERAL HOSPITAL

UNIVERSITY OF TORONTO

CALENDAR

Faculty of Applied Science
and Engineering

1949-1950

THE UNIVERSITY OF TORONTO PRESS
1949

CONTENTS

SECTION	I.	CALENDAR	5
"	II.	ADMINISTRATIVE OFFICERS	7
"	III.	TEACHING STAFF	8
"	IV.	HISTORICAL SKETCH	23
"	V.	ADMISSION AND REGISTRATION	25
"	VI.	FEES, DEPOSITS AND EXPENSES	29
"	VII.	COURSES AND DEGREES	31
"	VIII.	SCHOOL OF ENGINEERING RESEARCH	33
"	IX.	CURRICULUM	34
"	X.	EXAMINATIONS	142
"	XI.	SCHOLARSHIPS	144
"	XII.	LIBRARIES AND LABORATORIES	175
"	XIII.	DISCIPLINE	191
"	XIV.	UNIVERSITY HEALTH SERVICE AND PHYSICAL EDUCATION	193
"	XV.	HART HOUSE	198
"	XVI.	STUDENT ORGANIZATIONS	200
"	XVII.	LODGING AND BOARD	209
"	XVIII.	ENGINEERING ALUMNI ASSOCIATION	211
		APPENDIX I—GRADUATE STUDIES	213
		INDEX	218

1949 CALENDAR 1949

JANUARY

Sun.		2	9	16	23	30
Mon.		3	10	17	24	31
Tues.		4	11	18	25	....
Wed.		5	12	19	26	....
Thur.		6	13	20	27	....
Fri.		7	14	21	28	....
Sat.	1	8	15	22	29	...

FEBRUARY

Sun.	..	6	13	20	27
Mon.	..	7	14	21	28
Tues.	1	8	15	22	....
Wed.	2	9	16	23	....
Thur.	3	10	17	24	....
Fri.	4	11	18	25	....
Sat.	5	12	19	26	....

MARCH

Sun.	..	6	13	20	27
Mon.	..	7	14	21	28
Tues.	1	8	15	22	29
Wed.	2	9	16	23	30
Thur.	3	10	17	24	31
Fri.	4	11	18	25	..
Sat.	5	12	19	26	....

APRIL

Sun.	..	3	10	17	24
Mon.	..	4	11	18	25
Tues.	..	5	12	19	26
Wed.	..	6	13	20	27
Thur.	..	7	14	21	28
Fri.	1	8	15	22	29
Sat.	2	9	16	23	30

MAY

Sun.	1	8	15	22	29
Mon.	2	9	16	23	30
Tues.	3	10	17	24	31
Wed.	4	11	18	25	...
Thur.	5	12	19	26	...
Fri.	6	13	20	27	....
Sat.	7	14	21	28	...

JUNE

Sun.	..	5	12	19	26
Mon.	..	6	13	20	27
Tues.	..	7	14	21	28
Wed.	1	8	15	22	29
Thur.	2	9	16	23	30
Fri.	3	10	17	24	....
Sat.	4	11	18	25	....

JULY

Sun.		3	10	17	24	31
Mon.		4	11	18	25	....
Tues.		5	12	19	26	....
Wed.		6	13	20	27	....
Thur.		7	14	21	28	....
Fri.	1	8	15	22	29	....
Sat.	2	9	16	23	30	....

AUGUST

Sun.	..	7	14	21	28
Mon.	1	8	15	22	29
Tues.	2	9	16	23	30
Wed.	3	10	17	24	31
Thur.	4	11	18	25	....
Fri.	5	12	19	26	....
Sat.	6	13	20	27	....

SEPTEMBER

Sun.	..	4	11	18	25
Mon.	..	5	12	19	26
Tues.	..	6	13	20	27
Wed.	..	7	14	21	28
Thur.	1	8	15	22	29
Fri.	2	9	16	23	30
Sat.	3	10	17	24	....

OCTOBER

Sun.		2	9	16	23	30
Mon.		3	10	17	24	31
Tues.		4	11	18	25	..
Wed.		5	12	19	26	..
Thur.		6	13	20	27	....
Fri.		7	14	21	28	...
Sat.	1	8	15	22	29	....

NOVEMBER

Sun.	..	6	13	20	27
Mon.	..	7	14	21	28
Tues.	1	8	15	22	29
Wed.	2	9	16	23	30
Thur.	3	10	17	24	....
Fri.	4	11	18	25	....
Sat.	5	12	19	26	....

DECEMBER

Sun.	..	4	11	18	25
Mon.	..	5	12	19	26
Tues.	..	6	13	20	27
Wed.	..	7	14	21	28
Thur.	1	8	15	22	29
Fri.	2	9	16	23	30
Sat.	3	10	17	24	31

1950 CALENDAR 1950

JANUARY

Sun.	1	8	15	22	29
Mon.	2	9	16	23	30
Tues.	3	10	17	24	31
Wed.	4	11	18	25	....
Thur.	5	12	19	26	....
Fri.	6	13	20	27	....
Sat.	7	14	21	28	....

FEBRUARY

Sun.	..	5	12	19	26
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MAY

Sun.	..	7	14	21	28
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Fri.	5	12	19	26	....
Sat.	6	13	20	27	....

JUNE

Sun.	..	4	11	18	25
Mon.	..	5	12	19	26
Tues.	..	6	13	20	27
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Thur.	1	8	15	22	29
Fri.	2	9	16	23	30
Sat.	3	10	17	24	..

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Sun.		2	9	16	23	30
Mon.		3	10	17	24	31
Tues.		4	11	18	25	...
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Sat.	1	8	15	22	29	....

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Thur.	3	10	17	24	31
Fri.	4	11	18	25	....
Sat.	5	12	19	26	....

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Sun.	..	3	10	17	24
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Wed.	..	6	13	20	27
Thur.	..	7	14	21	28
Fri.	1	8	15	22	29
Sat.	2	9	16	23	30

OCTOBER

Sun.	1	8	15	22	29
Mon.	2	9	16	23	30
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Sat.	4	11	18	25	....

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Mon.		4	11	18	25	....
Tues.		5	12	19	26	....
Wed.		6	13	20	27	....
Thur.		7	14	21	28	....
Fri.	1	8	15	22	29	....
Sat.	2	9	16	23	30	....

SECTION I. CALENDAR 1949-1950

FALL TERM, 1949

July 1	*Friday*	Dominion Day. Buildings closed.
July 15	*Friday*	Last day for receiving applications for Supplemental Examinations.
August 1	*Monday*	Civic Holiday. Buildings closed.
August 20	*Saturday*	Students of the III Year, Courses 1, 2 and 9, report at Survey Camp (Course 1 at Dorset, Course 2 and 9 at Gull Lake).
August 29	*Monday*	Supplemental Examinations commence.
September 1	*Thursday*	Last day for receiving applications for admission to the I Year.
September 5	*Monday*	Labour Day. Buildings closed.
September 6	*Tuesday*	Students in II Year, Course 6, report for Chemical Laboratory.
September 12	*Monday*	Special meeting of Faculty Council.
September 15-17	*Thursday-Saturday*	Registration in person of the I Year from 9.30 a.m. to 12 noon and from 2.00 p.m. to 4.30 p.m., (Saturday 9.30 a.m. to 12.00 noon) at 119 St. George St., Toronto.
September 19	*Monday*	Registration in person of the II and III Years from 9.30 a.m. to 12.00 noon, and 2.00 p.m. to 4.30 p.m. at the Mining Building, Toronto.
September 20	*Tuesday*	Registration in person of the IV Year from 9.30 a.m. to 12.00 noon, and 2.00 p.m. to 4.30 p.m., at the Mining Building, Toronto. Dean's address to the I Year. Preliminary instruction to the I Year.
September 21	*Wednesday*	Lectures and laboratory work commence at 9.00 a.m. The opening address by the President to the students of all Faculties at 3.45 p.m., in Convocation Hall.
September 27	*Tuesday*	Meeting of Faculty Council.
October 3	*Monday*	Meeting of Faculty Council.
October 8	*Saturday*	Meeting of Caput.
*October 10	*Monday*	Thanksgiving Day. Buildings closed.
October 11	*Tuesday*	Meeting of Engineering Society.
October 14	*Friday*	Meeting of Senate.
November 2	*Wednesday*	Meeting of Faculty Council.

*Or such other date as may be determined by Order-in-Council.

November 11	*Friday*	Remembrance Day Service at the Soldiers' Tower, at 10.45 a.m. Neither lectures nor laboratory classes given from 10.00 a.m. to 11.15 a.m.
		Meeting of Engineering Society.
		Fall Convocation and meeting of the Senate.
December 1	*Thursday*	Meeting of Faculty Council.
December 7	*Wednesday*	Meeting of Engineering Society.
December 9	*Friday*	Meeting of Senate.
December 12	*Monday*	I Year Term Examinations commence.
December 16	*Friday*	Term ends at 5.00 p.m.

SPRING TERM, 1950

January 3	*Tuesday*	Spring Term begins.
		Mid-session Examinations commence.
January 9	*Monday*	Meeting of Faculty Council.
January 13	*Friday*	Meeting of Senate.
January 14	*Saturday*	Last day for receiving the second term instalment of fees.
January 17	*Tuesday*	Meeting of Engineering Society.
February 2	*Tuesday*	Meeting of Faculty Council.
February 9	*Thursday*	Meeting of Engineering Society.
February 10	*Friday*	Meeting of Senate.
February 22	*Wednesday*	Meeting of Engineering Society (nominations).
February 24	*Friday*	Engineering Society Annual Elections.
February 27	*Monday*	Engineering Society Annual General Meeting.
March 1	*Wednesday*	Meeting of Faculty Council.
March 10	*Friday*	Meeting of Senate.
March 25	*Saturday*	Term ends at 12.00 noon.
April 3	*Monday*	Meeting of Faculty Council.
April 4	*Tuesday*	Annual Examinations commence.
April 7	*Friday*	Good Friday, Buildings closed.
April 14	*Friday*	Meeting of Senate.
May 2	*Tuesday*	Meeting of Faculty Council.
May 12	*Friday*	Meeting of Senate.
May 29	*Monday*	Meeting of Senate.
June 1-2	*Thursday-Friday*	University Commencement.

SECTION II. ADMINISTRATIVE OFFICERS

THE UNIVERSITY

President . . . . . . Sidney Smith, K.C., M.A., LL.B., LL.D., D.C.L.

Registrar . . . . J. C. Evans, B.A.

Librarian . . . . W. S. Wallace, M.A., LL.D., F.R.S.C.

Warden of Hart House . . . . N. Ignatieff, M.B.E., B.SC.

Director of University Extension . . W. J. Dunlop, B.A., B.PAED., LL.D.

Assistant to the President . . . . C. T. Bissell, M.A., PH.D.

Comptroller . . . . R. E. Spence, B.A., A.C.A.

Bursar and Secretary to the Board of Governors C. E. Higginbottom, F.C.I.S.

Superintendent of Buildings and Grounds . . . A. D. LePan, B.A.SC.

Chief Accountant . . . . G. L. Court, D.F.C., B.COM., C.A.

Director of University Health Service . C. D. Gossage, O.B.E., M.D., F.R.C.S.

Assistant Director of University Health Service—Women
Miss F. H. Stewart, B.A., M.D.

Director of Athletics and Physical Education—Men . W. A. Stevens, B.S.

Assistant Director of Physical Education—Women Miss J. M. Forster, B.A.

General Manager of the University of Toronto Press . A. G. Burns, B.A.

Editor of the University of Toronto Press G. W. Brown, M.A., PH.D., F.R.S.C.

General Secretary-Treasurer of the Students' Administrative Council
E. A. Macdonald, B.A.

Associate Secretary of the Students' Administrative Council
Miss A. E. M. Parkes, B.A.

Director of Hart House Theatre . . . . R. Gill, M.A.

Director of the Placement Service . . . J. K. Bradford, O.B.E., B.A.SC.

THE FACULTY OF APPLIED SCIENCE AND ENGINEERING

Dean . . . C. R. Young, B.A.SC., C.E., D ENG., D ÈS SC. A., M.E.I.C., M.AM. SOC. C.E.

Associate Dean . . . . K. F. Tupper, O.B.E., B.A.SC., S.M. (MICH)

Assistant Dean and Secretary . . W. S. Wilson, E.D., B.A.SC., M.E.I.C.

SECTION III. TEACHING STAFF

1948-49

PROFESSORES EMERITI

G. R. Anderson, M.A., A.M. (Harv.), F.A.S.A., M.I.E.S. 5 du Maurier Blvd.
Professor Emeritus of Engineering Physics and Photography

R. W. Angus, B.A.Sc., M.E., Hon. M.E.I.C., Hon. Mem. A.S.M.E.
Professor Emeritus of Mechanical Engineering Mechanical Bldg.

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Professor Emeritus of Chemical Engineering

G. A. Guess, M.A. (Qu.) Oakville
Professor Emeritus of Metallurgical Engineering

H. E. T. Haultain, C.E. National Club
Professor Emeritus of Mining Engineering

H. W. Price, M.B.E., B.A.Sc., E.E. 40 Ava Road
Professor Emeritus of Electrical Engineering

C. G. Williams, B.A.Sc. 417 Rosemary Road
Professor Emeritus of Mining Engineering

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Professor of Civil Engineering and Aeronautics and Head of the Department

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Special Lecturer in Aeronautical Engineering

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Assistant Professor of Applied Physics 397 Glengrove Ave. W.

E. L. Dodington, B.A.Sc. 415 Sutherland Dr.
Assistant Professor of Applied Physics

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Lecturer in Applied Physics

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Instructor in Applied Physics

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Instructor in Applied Physics

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Instructor in Applied Physics

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Instructor in Applied Physics

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Demonstrator in Applied Physics

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G. N. Smith 531-A College St.
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Lecturer in Chemical Engineering

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Lecturer in Chemical Engineering — 14 Birch Cres., Ajax

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A. V. DeLaporte, B.A.Sc., C.E. — 5 Millerson Ave.
Special Lecturer in Sanitary Chemistry in Chemical Engineering (part time)

M. Adelman, Ph.D. — 324½ Bloor St. W.
Instructor in Chemical Engineering (part time)

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Instructor in Chemical Engineering (part time)

R. N. Dempster, B.A.Sc. — 42 Haslemere Rd.
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Instructor in Chemical Engineering

J. G. Fraser, B.Sc. (Mt.A.) — 42 Glynn Ave., Ajax
Instructor in Chemical Engineering

A. W. Ludlam, B.A.Sc., — 46 St. George St.
Instructor in Chemical Engineering

F. G. Roughton, B.A. — 401 Pape Ave.
Instructor in Chemical Engineering

Samuel Sandler, M.A.Sc. — 217 Robert St.
Instructor in Chemical Engineering

J. E. Thomas, B.S.A. — Ajax
Instructor in Chemical Engineering

L. A. Williams, B.A. (Sask.) — 26 Mary St., Ajax
Instructor in Chemical Engineering

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Demonstrator in Chemical Engineering

D. R. Arntfield, B.A.Sc. — Centre Rd., Port Credit
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M. Bergman, C.E. (Zurich), Ph.D. (Geneva) — 931 College St.
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A. P. Coccotas, B.A.Sc. (Athens) — Arbor Lodge, Ajax
Demonstrator in Chemical Engineering

Miss L. I. Cowan, B.Sc. (Dal.) — 46 Lowther Ave.
Demonstrator in Chemical Engineering

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Demonstrator in Chemical Engineering

D. H. Francis, B.A.Sc. 404 Briar Hill Ave.
Demonstrator in Chemical Engineering

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Demonstrator in Chemical Engineering

E. H. Greig, B.A. (Qu.) 18 Royal York Rd. S.
Demonstrator in Chemical Engineering

A. J. Gunn, B.S. (Qu.) Arbor Lodge, Ajax
Demonstrator in Chemical Engineering

A. E. Johnson, B.A.Sc., M.Ch.E. (Poly. Inst. Brooklyn) 22 Chilton Rd.
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W. S. Karpinski, Diploma, Politechnika Lwowska, Poland
Demonstrator in Chemical Engineering Arbor Lodge, Ajax

N. L. Kelly, B.A.Sc. 17 Joicey Blvd.
Demonstrator in Chemical Engineering

C. M. Lampl, B.S. (Carnegie) 1032 College St.
Demonstrator in Chemical Engineering

M. J. Mann, B.Sc. (Man.) 743 Queen's Rd., Ajax
Demonstrator in Chemical Engineering

D. MacDowell, M.Sc. (Queen's, Belfast) 97 Avenue Rd.
Demonstrator in Chemical Engineering

G. L. Milligan, B.A.Sc. 106 Bernard Ave.
Demonstrator in Chemical Engineering (part-time)

H. W. Moore, Ph.M.B. Moorecroft, Dunbarton
Demonstrator in Chemical Engineering

W. Sacks, B.A.Sc. 180 Grace St.
Demonstrator in Chemical Engineering

Sydney Sandler, B.A.Sc. 37 Harbord St.
Demonstrator in Chemical Engineering

H. Shanfield, B.A.Sc., M.A.Sc. 479 Dundas St. W.
Demonstrator in Chemical Engineering

W. W. Thompson, B.A. 5 Southlea Ave., Leaside
Demonstrator in Chemical Engineering (part time)

G. L. D. Upham, B.A. Windsor Arms Hotel
Demonstrator in Chemical Engineering

R. G. Whelan, B.A.Sc. 95 Breadalbane St.
Demonstrator in Chemical Engineering

L. W. Wray, B.A., M.A. (West.) 105 Ronan Ave.
Demonstrator in Chemical Engineering

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Special Demonstrator in Sanitary Chemistry in Chemical Engineering

DEPARTMENT OF CIVIL ENGINEERING MUNICIPAL AND STRUCTURAL

T. R. Loudon, V.D., B.A.Sc., M.E.I.C., M.I.Ae.Sc. 189 Sheldrake Blvd.
Professor of Civil Engineering and Aeronautics and Head of the Department

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SECTION IV. HISTORICAL SKETCH

The Legislative Assembly of the Province of Ontario during the Session of 1877 gave its sanction to the establishment of a School of Practical Science on the basis proposed in the memorandum of the Minister of Education confirmed by the Lieutenant-Governor in Council on the 3rd day of February, 1877.

By the scheme thus approved the Government effected an arrangement with the Council of University College whereby the instruction given by its professors and lecturers in all departments of science embraced in the work of the School was made available to students of the School This arrangement was brought to an end in 1889 by the transfer of the departments of science, above referred to, from University College to the University of Toronto under the operation of the University Federation Act. In order that the students of the School might continue to enjoy the advantage of the instruction of the above departments, the Senate of the University of Toronto passed a statute in October, 1889, affiliating the School with the University. The statute was confirmed by the Lieutenant-Governor on the 30th day of October, 1889.

By an Order-in-Council, approved by the Lieutenant-Governor on the 6th day of November, 1889, a Principal was appointed, and the management of the School was entrusted to a council composed of the Principal as chairman, and the Professors, Lecturers, and Demonstrators appointed in the Teaching Faculty of the School.

On December 14th, 1900, the Senate, by statute subsequently approved by the Lieutenant-Governor in Council, established a Faculty of Applied Science and Engineering but without assuming any liability for its support or maintenance. Under this statute the teaching staff and examiners of the School of Practical Science became the teaching staff and examiners of the Faculty, although the University retained the right to appoint the examiners for the Bachelor of Applied Science and professional degrees. By the University Act of 1906 the School of Practical Science became the Faculty of Applied Science and Engineering of the University of Toronto.

On April 8th, 1892, the Senate of the University established the Degree of B.A.Sc., which was open to those who held the Diploma of the School and were prepared to devote a fourth year to advanced work. In the Session of 1909-1910 a new course extending over four years and leading to the Degree of B.A.Sc., came into operation, taking the place of the long established diploma course of three years, which came to an end in the Session 1910-1911. In the session 1923-24 the degree was changed to B. Arch. for the students graduating in Architecture. On July 1, 1948, the School of Architecture was separated from the Faculty and became an independent School with its own Director and Council.

With the end of the Second World War during the summer of 1945 the University was faced with the difficult problem of providing accommodation for almost double the number of students that had been registered in the previous year. Through the efforts of the Chairman of the Board of Governors and the President, the University leased from the Crown part of the large shell-filling plant at Ajax, twenty-five miles east of Toronto, to relieve the heavy demand for space at Queen's Park. Because it became evident, at an early stage, that a relatively large number of students would register in the Faculty of Applied Science and Engineering, it was decided that the work of the First and Second Years of this Faculty should be given at Ajax.

A special First Year session with approximately 1400 students commenced at Ajax on January 14, 1946. In the regular 1946-47 session both First and Second Year instruction, except Second Year in Architecture, was given at Ajax with 1800 registered in the First Year and 1500 in the Second Year. In the 1947-48 session the enrolment at Ajax consisted of 1200 students in the First Year and 1400 in the Second Year. In the session 1948-49, 600 were registered at Ajax in the First Year and 975 in the Second Year. All other instruction was given in Toronto.

To provide for this self-contained University community at Ajax, there were 446 acres and 111 buildings. The University operated such services as central heating, road maintenance, water supply, sewage disposal, fire department, transportation, post office, laundry, private hospital, cafeteria, tuck shop and barber shop. Former production-line buildings were altered to accommodate 37 lecture rooms, 20 draughting rooms and 14 laboratories. In the 1946-47 session, 2300 students were in residence, in 1947-48 there were 1800 students and in 1948-49 there were 900. Student life at Ajax compared favourably with that in Toronto, excellent accommodation being provided for a general circulating library, a technical library, Hart House Ajax, the Athletic Association, the Health Service, Students' Administrative Council, Advisory Bureau for Ex-Service Students, and a small chapel.

With the completion of the Wallberg Building and the extension of the Mechanical Building, additional accommodation became available on the Queen's Park Campus, and this fact coupled with the decrease in numbers entering each year brought about the closing of Ajax on May 31, 1949.

SECTION V. ADMISSION AND REGISTRATION

Inquiries about admission to this Faculty should be sent to the Registrar of the University.

CHANGE IN ADMISSION REQUIREMENTS

Commencing with the Session 1950-51, applicants for admission to the Faculty of Applied Science and Engineering will be required to have at least third class honours in each subject of their Grade XIII examination.

GENERAL

1. Candidates for admission in 1949 to the Faculty of Applied Science and Engineering must submit the certificates listed below as evidence that they are qualified to take one of the courses of instruction and proceed to a degree. Applicants must also submit a certificate of good character, and must have completed the seventeenth year of their age. The procedure for application and registration is described in paragraph 8 below.

2. In general, the holding of any of the following classes of certificate will constitute qualification for admission to this Faculty.

(*a*) The Ontario Secondary School Graduation Diploma in either the General Course or the Vocational Course (Industrial Department), and the Ontario Grade XIII certificate as described in paragraph 3 below.

(*b*) Certificates of having passed certain equivalent examinations as described in paragraph 5 below.

(*c*) Certificates of undergraduate work in other universities. See admission to advanced standing, paragraphs 6 and 7 below.

The Senate will consider applications for the recognition of certificates other than those mentioned as occasion may require. Such certificates must be accompanied by an official statement of the marks in the various subjects upon which the certificate was granted.

Students from foreign countries must, in addition to providing the necessary equivalent certificates, give evidence of their ability to understand lecture and laboratory courses where the English language is used exclusively, and must demonstrate their ability to use this language in both the spoken and written form, with reasonable facility. Such students are strongly advised to spend a year in Grade XIII of an Ontario Secondary School before seeking admission to this Faculty.

Secondary School Graduation Diploma

3. No subjects are definitely prescribed, but the diploma must show credit in English and History, and in four of the optional subjects.

Grade XIII

English
Mathematics (Algebra, Geometry, Trigonometry)
Science (Chemistry and Physics)
One of French
German
Greek
Italian
Latin
Spanish

It is highly desirable that applicants for admission should have a good standing in Mathematics (Algebra, Geometry, Trigonometry).

A candidate applying to enter the course in Engineering Physics must have met the regular requirements for admission to the faculty and, in addition, have obtained an average of seventy-five per cent. in Mathematics (Algebra, Geometry, and Trigonometry) of the Grade XIII examination. A candidate whose general proficiency record in other subjects is not considered by the Council to be sufficiently high will not be admitted.

A candidate applying to enter the course in Aeronautical Engineering must have met the regular requirements for admission to the Faculty, and, in addition, must have good standing in Mathematics and Science. A candidate whose general proficiency record in other subjects is not considered by the Council to be sufficiently high will not be admitted to the course.

4. Those intending to enter Chemical, Civil, Electrical, Mechanical, Metallurgical Engineering, or Engineering Physics are advised to select German as one of the admission subjects.

EQUIVALENT CERTIFICATES

5. Certificates of the following examinations recognized as equivalent in value to the Ontario Secondary School Graduation Diploma and Grade XIII certificate, generally known as Junior and Senior Matriculation respectively, may be accepted in so far as they meet the admission requirements of the University of Toronto and conform to the admission requirements of the universities of the respective provinces. A candidate applying for admission on such certificates must submit an official statement of the marks upon which these certificates were awarded.

Province of Quebec
Quebec High School Leaving and Senior High School Leaving certificates; the Junior and Senior Matriculation certificates of McGill University.

Province of New Brunswick
Junior and Senior Matriculation certificates.

Province of Nova Scotia

High School certificates of Grade XI and Grade XII issued or endorsed by the Department of Education.

Province of Manitoba

The Junior (Grade XI) and Senior (Grade XII) Matriculation certificates.

Province of British Columbia

The University Entrance or Junior Matriculation certificate and the Senior Matriculation certificate.

Province of Prince Edward Island

Second and Third Year certificates issued by the Prince of Wales College.

Province of Alberta

The Junior (Grade XI) and Senior (Grade XII) Matriculation certificates.

Province of Saskatchewan

The Junior (Grade XI) and Senior (Grade XII) Matriculation certificates.

Newfoundland

Junior and Senior Associate diplomas of the Department of Education.

Newfoundland and the Maritime provinces

Certificates of the Common Examining Board.

Great Britain

Certificate of having passed, or having exemption from the Preliminary Examination of the Institution of Civil Engineers in the British Isles, or equivalent.

ADMISSION TO ADVANCED STANDING

6. An undergraduate of another university may be admitted to advanced standing on such conditions as the Senate, on the recommendation of the Council of the Faculty, may prescribe.

7. An applicant for admission to advanced standing must submit with his application for admission: (1) an official transcript of his record in the University from which he wishes to transfer, showing in detail the courses which he has completed, with his standing in each; (2) certificate of honourable dismissal; (3) calendar of the university giving a full description of these courses.

PROCEDURE FOR APPLICATION AND REGISTRATION

8. Candidates for admission should apply to the Registrar of the University for forms of applications for admission; they are required to fill in these forms in duplicate and return them to the Registrar *not later than* September 1st, together with the following: (*a*) the Ontario Secondary School Graduation Diploma in the General Course and the Ontario Grade

XIII certificate; (*b*) any other evidence of ability to take the work proposed; (*c*) certificate of good character. Failure to make early application will result in delay and inconvenience for the candidate.

9. Every person admitted to the University as an undergraduate must, at the time of his or her first medical examination by the University Health Service, present satisfactory evidence of successful vaccination, or must be vaccinated by the examining physician.

10. Every student must register in person with the Secretary of the Faculty as prescribed on page 5 of the Calendar.

11. A student who fails to register as prescribed in clause 10, must petition the Council for permission to register late. The Council, however, reserves the right to refuse the permission, or to impose a penalty, such penalty to be reckoned at one dollar per day, or part thereof, that elapses between the close of registration as prescribed and the filing of the petition.

12. A petition for permission to register late must be accompanied by a deposit equal to the estimated amount of the penalty. Should the Council decide that no penalty is to be imposed, the deposit will be refunded.

SECTION VI. FEES, DEPOSITS AND EXPENSES

FEES

1. A student who desires to enrol in the Faculty of Applied Science and Engineering is required to pay at least the First Term Instalment of fees on or before the opening date of the session, and before he can receive his registration card from the Secretary of the Faculty. The amount of the First Term Instalment of fees or of the Total Fee for the session may be ascertained from the schedule of fees below.

2. The Second Term Instalment of fees, if not already paid, is payable on or before January 15th. After this date an additional fee of $1.00 a month will be imposed until the whole amount is paid. All fees for the session must have been paid in full before the student can be admitted to the annual examinations.

3. In order to avoid delay in registration at the opening of the session it is recommended that at least the First Term Instalment of fees be forwarded by mail as early as possible in September, together with a form, in duplicate, to be provided by the Secretary of the Faculty and filled out by the student, giving his full name, course, year, etc.

4. University fees are payable at the Office of the Chief Accountant, Simcoe Hall, which will be open for the receipt of fees from 9 a.m. to 5 p.m. daily from September 12th to 21st (Saturday, September 17th, 9 a.m. to 12.30 p.m.), and from 9 a.m. to 1 p.m. daily except Saturday during the remainder of the session. Cheques in payment of these fees should be made payable to the University of Toronto at par in Toronto.

5. Each undergraduate enrolled in the Faculty of Applied Science and Engineering must pay annual fees to the Chief Accountant according to the schedule below; the total fee in each case is made up of the academic fee and incidental fees; all incidental fees are payable in the first term.

Schedule of Fees

Academic Year	*Academic Fee	†Incidental Fees	Total Fee (if paid in one instalment)	First Term Instalment	Second Term Instalment
Men					
First, Second, Third	$300	$41	$341	$191	$153
Fourth	300	51	351	201	153
Women					
First	$300	$27	$327	$177	$153
Second, Third	300	24	324	174	153
Fourth	300	34	334	184	153

*The Academic Fee includes the following fees:—
Tuition; Library, Laboratary Supply; and one Annual Examination.

†These Incidental Fees include the following fees:—
For men—Degree (for the final year only): Hart House; Students' Administrative Council; Athletic; Health Service; Physical Education; Engineering Society; Faculty Athletic Association; and Laboratory Deposit.
For woman—Degree (for final year only); Students' Administrative Council; Athletic; Health Service; Physical Education (for the First Year only); Engineering Society; and Laboratory Deposit.

OTHER UNIVERSITY FEES

6. Each student is required to pay to the Chief Accountant at the opening of the session, or as otherwise specified, such of the following fees as may be required of him.

EQUIVALENT CERTIFICATE FEE

7. Each student who has been admitted to the First Year upon a certificate or certificates granted outside the Province of Ontario and covering all or any part of the admission requirements, must pay a fee of $5.00.

ADVANCED STANDING FEE

8. Each student who has been admitted to advanced standing from another university or college, must pay a fee of $10.00.

SUPPLEMENTAL PHYSICAL EDUCATION FEE

9. Each student who has neglected to complete satisfactorily the course in Physical Education of the First or Second Year, and who must take this work during the Second or Third Years respectively of his or her attendance, must pay a fee of $10.00.

SUPPLEMENTAL EXAMINATION FEES

10. Each candidate for a supplemental examination is required to pay a fee to the Chief Accountant not later than August 15th. The fee is $10.00 for either one or two supplemental examinations, including laboratory supplementals. For each supplemental examination in a laboratory subject requiring special supervision, there is an additional fee of $10.00. The additional laboratory supplemental fee should not be paid until the candidate is notified by the Secretary.

DEGREE FEE

11. Each candidate for the degree of Bachelor of Applied Science must pay a fee of $10.00 to the Chief Accountant on or before the opening date of the session.

LABORATORY DEPOSIT

12. A laboratory breakage deposit of $10 is included in the incidental fees. This deposit, less charges for waste, neglect, and breakages will be refunded at the end of the session. Should the deposit be insufficient to meet the charges, a levy will be made to cover the deficiency.

SUMMARY OF STUDENTS' EXPENSES

13. The following approximate statement of expenses will give the student a general idea of the cost of obtaining an education in the Faculty of Applied Science and Engineering in the University of Toronto, exclusive of personal expenses:—

1. Fees, see schedule, page 29.
2. Board and Lodging, per week.................. $15 up
3. Books and instruments, per year................ $50 to $60

SECTION VII. COURSES AND DEGREES

1. At the time of registration in the Faculty, the applicant is required to indicate the graduating course in which he intends to proceed to a degree. There are eleven courses in Engineering, from which the selection may be made, viz.,

Civil Engineering (Course 1),
Mining Engineering (Course 2),
Mechanical Engineering (Course 3),
Engineering Physics (Course 5),
Chemical Engineering and Applied Chemistry (Course 6),
Electrical Engineering (Course 7),
Metallurgical Engineering (Course 8),
Ceramic Engineering (Course 8a),
Mining Geology (Course 9),
Aeronautical Engineering (Course 10),
Engineering and Business (Course 11).

2. The Degree of Bachelor of Applied Science will be awarded to students who complete one of the above courses.

3. The courses extend over four academic years. A student must pass in the work of each academic year before proceeding to the work of the next. See Sec. X.

4. If, for any reason, an undergraduate wishes to change his course, he must petition the Faculty Council and obtain its approval. Such petition should be submitted by September 15.

5. Students must conform to all lecture room and laboratory regulations. Reports, briefs, theses, and drawings become the property of the Council to dispose of as it may see fit. Drawings, briefs, and field notes will not be accepted unless they have been made at the time and place provided in the time-table.

6. The curricula of the courses of instruction are given in Sec. IX.

7. Examinations are conducted as explained in Sec. X.

8. Students in Civil Engineering, Mining Engineering, Mechanical Engineering, Electrical Engineering, and Mining Geology and Engineering and Business are required to have practical experience in offices, shops, or field, before their degree is granted. Students are asked to submit certificates of this experience as soon as possible after the completion of each period of work. (See Sec. IX.)

GRADUATE AND PROFESSIONAL DEGREES

1. Graduates in Engineering may proceed to post-graduate and professional degrees. The post-graduate degrees are M.A.Sc., and Ph.D. The professional degrees are C.E., Chem. E., E.E., M.E. (Mechanical Engineer), M.E. (Mining Engineer), and Met. E.

2. Bursaries and scholarships for graduate students are available in limited number as shown on page 144. Many part-time demonstratorships are open which permit post-graduate work towards a degree.

3. The course for these degrees are under the direction of the School of Graduate Studies, and candidates should send their inquiries to the Secretary of the School of Graduate Studies. Page 213 of this Calendar contains further information on graduate studies in Applied Science and Engineering.

ASSOCIATIONS OF PROFESSIONAL ENGINEERS

Graduation from the Faculty of Applied Science and Engineering leads to registration as a Professional Engineer in the various Associations of Professional Engineers throughout Canada.

SECTION VIII. SCHOOL OF ENGINEERING RESEARCH

THE SCHOOL

A School of Engineering Research, within the Faculty of Applied Science and Engineering, was established in the Spring of 1917 at the suggestion of the late Dean Ellis.

The School is under the direct supervision of a Committee of Management composed of members of the Faculty Council. To this Committee of the Council is entrusted the selection of researches to be undertaken under the auspices of the School, and the disposition of funds for conducting them.

The School was organized chiefly for the training of graduates in methods of research and for the carrying out of investigations. These latter may be problems relating to specific industries of raw materials and having a specific end in view, or general problems having to do with fundamental principles.

RESEARCH ASSISTANTS

A number of research assistants in the School of Engineering Research are appointed annually on salary in the various departments of the Faculty to carry on the work of research under direction of members of the staff. This work is accepted as partial fulfilment of the requirements for the degrees of M.A.Sc., and Ph.D. These research assistants are usually recent graduates, and are chosen from among those who have displayed special capacity for investigation in their undergraduate courses. Applicants should consult with members of the staff as soon as possible after the April examinations.

The facilities of the School are also open to graduates who desire to penetrate more deeply into particular phases of experimental work, or to undertake investigations either suggested by members of the staff or arising from their own work since graduation.

INQUIRIES

All communications should be sent to the Secretary of the Committee of Management, Mr. W. S. Wilson.

SECTION IX. CURRICULUM

The courses of instruction are designed to give the student a thorough grounding in the fundamentals of engineering or architecture, and, in addition, sufficient familiarity with the practical application of the principles to make him useful upon graduation. The courses are very similar in the First Year with the exception of those of Engineering Physics, and Aeronautical Engineering. In the succeeding years specialization develops to some extent with provision in the Third and Fourth years for optional subjects in some of the graduating courses.

In the teaching of fundamentals, instruction is not confined wholly to Applied Science. As the future engineer is vitally concerned with the development of the country, it is essential that he be instructed in the rudiments of economics, administration, and business, which, with his scientific training, will enable him to increase his usefulness to the full.

Recognizing the growing emphasis of outstanding engineers and of the great professional organizations on the importance of breadth in engineering education, this Faculty liberalized its curricula in engineering and architecture, effective with the session 1944-45. The subjects that are considered to belong to the liberal stem, involving about 6 per cent of the total time of four undergraduate years, are the following: First Year English, and Engineering and Society; Second Year Economics; Third Year Modern World History, and Introduction to Political Science; Fourth Year Modern Political and Economic Trends, Philosophy of Science, and The Profession of Engineering.

Care has been taken to co-ordinate the liberal studies of the curriculum in such a manner as to form an integrated whole. Each derives support from those that have gone before and is the better understood by reason of them.

While a knowledge of these subjects does not form a part of the technical equipment of the engineer, it does add markedly to his ability to function as a broadly educated and effective citizen and thereby advances the prestige of his profession and himself in the mind of the general public.

The student who thoughtfully attends to what is offered in this so-called humanistic-social programme and follows it by self-directed reading and reflection will without question add notably to his qualifications for ultimate professional leadership. He will be the better able to discharge the double obligation laid upon him—to perform his technical duties efficiently and honourably and equally to contribute to the political, social, and cultural welfare of the community and country in which he lives.

In some graduating courses, laboratory work in the Fourth Year consists of the investigation of some specific problem. In all instances the student's knowledge of the original literature and primary sources of information is extended, and he is given a very desirable and useful training

in methods of research. In this way the undergraduate course is linked with the graduate courses (page 214), and with the work of the School of Engineering Research (page 33).

As part of the laboratory instruction, excursions to places of technical interest, both in Toronto and elsewhere, are arranged by the staff. These excursions are treated as laboratory periods with the same requirements as to attendance and reports. The total transportation costs in any one year will probably not exceed ten dollars.

On the following pages of this section, the curriculum for each course is set forth in detail. The time devoted to lectures and practical work is indicated as accurately as possible, but is subject to modification as occasion may require. The program and regulations regarding the courses of study and examination, contained in this Calendar, hold good for this academic year only, and the Faculty of Applied Science and Engineering does not bind itself to adhere for the whole period of a student's course to the conditions here laid down.

Communications relating to curricula, instruction, and examinations in the Faculty of Applied Science and Engineering should be sent to the Secretary of the Faculty.

For information regarding the courses of study leading to the post-graduate degrees, Master of Applied Science, and Doctor of Philosophy, see pages 214 and 215 of this calendar, and the calendar of the School of Graduate Studies, which gives full particulars.

CIVIL ENGINEERING

(Course 1)

The normal course in Civil Engineering has been so designed as to be broad and comprehensive, with a view to meeting not only the needs of those who have definitely decided to enter this branch of the profession, but also of those who desire a technical training of such a basic character as to enable them to enter various other fields of technical employment. Concurrent with the instruction in engineering subjects, sufficient attention is given to economic, legal, and administrative matters to make the graduate in this course fitted to enter not only upon such work as Municipal Engineering, Sanitary Engineering, Highway Engineering, Railway Engineering, Geodetic Surveying, Structural Engineering, and Hydraulic Engineering, but also upon administrative and executive work in both engineering and industrial undertakings.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Analytical Geometry, 492, page 123.

PRACTICAL EXPERIENCE

Before receiving the degree, every student in Civil Engineering is required to submit satisfactory evidence of having had at least 600 hours of practical experience. (see subject 690.)

GRADUATE STUDY

Graduates of this University, or of other universities of comparable standing, who have taken the above-mentioned or similar course with sufficiently high records may proceed with work leading to a graduate degree.

The time devoted to graduate study is divided between work on the subjects of mathematics, physics, fundamentals of civil engineering and related work on the approved civil engineering field of investigation chosen by the candidate.

Further information appears on page 213. The Calendar of the School of Graduate Studies should be consulted for details.

First Year Subjects Course 1	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry	492, 275	1	1	2	1
Calculus	490, 275	2	2	2	2
Chemistry	221, 222	2	–	2	6
Descriptive Geometry	270	1	–	1	–
Dynamics	21, 275	1	1	2	1
Electricity	330	2	–	2	–
Engineering and Society	322	1	–	1	–
Engineering Problems and Drawing	275	–	9	–	4
English	610	1	–	1	–
Physical Training	640	–	2	–	2
Practical Experience	690	–	–	–	–
Statics	20, 275	1	1	2	1
Surveying	710, 712	1	3	–	–

Second Year Subjects Course 1	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Alternating Currents	331, 350	1	–	1	3
Applied Physics	75, 76	1	3	1	3
Calculus	491	2	–	2	–
Descriptive Geometry	272	1	–	1	–
Dynamics	22	1	–	1	–
Economics	311	2	–	2	–
Engineering Chemistry	226	1	–	1	–
Engineering Problems and Drawing	284	–	8	–	8
Hydraulics, Elementary	447	1	–	–	–
Least Squares	494	–	–	1	–
Mechanics of Materials	23, 31	2	–	2	3
Physical Training	640	–	2	–	2
Practical Astronomy	200	–	–	2	–
Practical Experience	690	–	–	–	–
Spherical Trigonometry	493	1	–	–	–
Surveying	714, 716	1	8	1	–

Third Year Subjects Course 1	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Applied Elasticity	33	1	–	1	–
Astronomy and Geodesy	201	–	–	2	–
Business	310	–	–	1	–
Cements and Concrete	35, 44	1	2	1	–
Construction Surveying	718	1	–	1	–
Descriptive Geometry	274	1	–	–	–
Differential Equations	507	1	1	1	1
Elementary Structural Engineering	28	2	–	2	–
Engineering Problems and Drawing	291	–	10	–	9
Engineering Geology	385, 386	1	–	2	2
Heat Engines, Theory	427, 428	1	–	1	2
Hydraulics	440, 441	2	–	2	3
Lithology	592	1	1	–	–
Machinery	463, 464	2	3	–	–
Modern World History	324	1	–	1	–
Photographic Surveying	81	1	–	–	–
Physical Metallurgy	546	–	–	1	–
Political Science	323	1	–	1	–
Practical Experience	690	–	–	–	–
Survey Camp	720	–	–	–	–

Fourth Year Subjects Course 1	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Contracts and Spcifications	315	1	–	–	–
Engineering Economics	313	–	–	1	–
Engineering Law	314	1	–	–	–
Foundations	39, 299	1	–	1	–
Highway Engineering	217	1	–	1	–
Hydraulics	445, 446	2	3	2	3
Industrial Management	318	1	–	1	–
Mechanics of Materials Lab	38, 50	–	3	–	6
Modern Political and Economic Trends	325	1	–	1	–
Municipal Administration	216	–	–	1	–
Philosophy of Science	326	1	–	½	–
Practical Experience	690	–	–	–	–
Profession of Engineering	327	–	–	½	–
Sanitary Engineering	214, 215	1	3	1	3
Soil Mechanics	40	1	–	–	–
Railway Engineering	218	1	–	1	–
Reinforced Concrete	41, 299	1		1	
Structural Design	43, 299	2	6	1	6
Theory of Structures	36, 299	2		2	
Thesis	730	–	–	–	2

MINING ENGINEERING

(Course 2)

The course in Mining Engineering, which originated in 1878 as a course in Assaying and Mining Geology, is intended to serve as a preliminary training for those who expect to practise in some branch of Mining Engineering, such as exploration of mining areas and primary development; mine surveying; mining processes involving civil, mechanical and electrical work; underground operations; mining machinery and operation; milling and treatment of ores; assaying and other forms of analysis and research; and administrative work in both engineering and industrial undertakings.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Analytical Geometry, 492, page 123.

PRACTICAL EXPERIENCE

Before receiving the degree, every student in Mining Engineering is required to present satisfactory evidence of having had at least six months' practical experience. (See subject 691.)

GRADUATE STUDY

Graduates of this University, or of another university of comparable standing, who have taken the above course with a sufficiently good standing may proceed with work leading to a graduate degree.

The major portion of the student's time will be devoted to research work on some subject approved by the Department, but certain specified courses of instruction must also be taken, in which examinations are demanded.

Further information appears on page 213 of this Calendar. The Calendar of the School of Graduate Studies should be consulted for details.

First Year Subjects Course 2	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry	492	1	–	2	–
Calculus	490	2	–	2	–
Chemistry	221, 222	2	6	2	6
Descriptive Geometry	270	1	–	1	–
Dynamics	21	1	–	2	–
Electricity	330	2	–	2	–
Engineering and Society	322	1	–	1	–
Engineering Problems and Drawing	276	–	6	–	6
English	610	1	–	1	–
General Geology	388	–	–	3	–
Mechanical and Thermal Measurements	448	1	–	1	–
Mining Laboratory	165	–	–	–	2
Physical Training	640	–	2	–	2
Practical Experience	691	–	–	–	–
Statics	20	1	–	2	–
Surveying	710, 712	1	3	–	–

Second Year Subjects Course 2	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Alternating Currents	331, 350	1	–	1	3
Analytical Chemistry Laboratory	227	–	–	–	3
Chemistry	224	1	–	1	–
Descriptive Geometry	272	1	–	1	–
Economics	311	2	–	2	–
Engineering Problems and Drawing	285	–	8	–	8
Heat, Engines, Elementary	420	1	–	–	–
Lithology	585	1	–	–	1
Mechanics of Materials	23, 31	2	–	2	3
Mineralogy, Determinative	587	–	2	–	–
Mineralogy, Elementary	580, 581	2	1	–	–

SECOND YEAR SUBJECTS COURSE 2—*Continued*	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Mining	166	1	–	–	–
Optical Mineralogy, Elementary	589	–	–	1	–
Physical Training	640	–	2	–	2
Practical Experience	691	–	–	–	–
Problems and Seminar	193	–	2	–	–
Surveying	715, 717	1	6	1	–
Theory of Measurements	190	1	–	–	–

THIRD YEAR SUBJECTS COURSE 2	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Chemistry	225, 237	1	4	1	3
Assaying	160, 161	1	3	1	3
Business	310	–	–	1	–
Cements and Concrete	35	1	–	1	–
Economic Geology	399	2	–	1	–
Electrical Machinery	348	2	–	–	–
Elementary Structural Engineering	29	1	–	1	–
Engineering Problems and Drawing	292	–	3	–	–
Geological Field Work	380	–	–	–	–
Hydraulics	440, 441	2	1½	–	–
Metallurgy	530	1	–	–	–
Mining	168	1	–	1	–
Mining Laboratory	169	–	–	–	3
Modern World History	324	1	–	1	–
Ore Dressing	181, 182	–	–	2	6
Petrology Laboratory	590	–	–	–	2
Political Science	323	1	–	1	–
Practical Experience	691	–	–	–	–
Principles of Mineral Dressing	180	2	–	–	–
Problems and Seminar	193	–	2	–	–
Structural Geology	390, 391	1	3	1	3
Summer Letters	191	–	–	–	–
Survey Camp	720	–	–	–	–

Fourth Year Subjects Course 2	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Engineering Economics	313	–	–	1	–
Geology, Precambrian	392	2	–	–	–
Geology, Mining	396	–	–	2	–
Geology, Pleistocene and Physiographic	381, 382	1	1	1	–
Heat Engines, Theory	427, 428	1	1½	1	–
Hydraulics	451	–	–	1	–
Machine Design	469, 470	1	–	1	3
Metallurgy	538, 539	1	–	1	3
Mine Management	171	2	–	–	–
Mine Ventilation	175, 176	2	3	–	–
Mining	172, 170	–	–	2	6
Modern Political and Economic Trends	325	1	–	1	–
Ore Dressing	183, 184	1	6	1	–
Physical Metallurgy	549	1	–	1	–
Practical Experience	691	–	–	–	–
Profession of Engineering	327	–	–	½	–
Problems and Seminar	193	–	2	–	–
Philosophy of Science	326	1	–	½	–
Summer Essays	192	–	–	2	–
Thesis	731	–	6½	–	5

MECHANICAL ENGINEERING

(COURSE 3)

The mechanical engineer is concerned with the production and the use of power; and it is part of his work to design and manufacture suitable machinery for this purpose, and to install and operate it. The internal combustion engine and the steam turbine are the products of his effort, and he applies these prime movers to automobiles, aeroplanes, locomotives, and other purposes. His work also includes the design of water turbines and their use in hydro-electric systems.

Other branches of his work are the making of designs for air compressors, machine tools, pumps, refrigerating machines and their application to storage warehouses and ice-making, heating and ventilating equipment, materials-handling and conveying plants, and generally all mechanical work. General industrial and administrative problems are considered.

The course of study has been devised to equip men for work in the general field of mechanical and industrial engineering.

The subjects of instruction are shown in the following tables In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Analytical Geometry, 492, page 123.

SHOP WORK

Before receiving the degree, every student in Mechanical Engineering is required to spend 1200 hours in mechanical shops, either prior to entering or during the vacations. (See subject 692.)

GRADUATE STUDY

Graduates of this University, or of another university of comparable standing, who have taken the above course, or one similiar, with a sufficiently good standing may proceed with work leading to a graduate degree.

Some part of the instructional period will be devoted to advanced work in Mathematics and the Fundamentals of Engineering. The remainder of the time will be given to a study of some specific branch of Mechanical Engineering work or to some definite Mechanical problem.

Further information appears on page 213. The Calendar of the School of Graduate Studies should be consulted for details.

First Year Subjects Course 3	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry	492, 277	1	1	2	1
Calculus	490, 277	2	2	2	2
Chemistry	221, 222	2	6	2	–
Descriptive Geometry	270	1	–	1	–
Dynamics	21, 277	1	1	2	1
Electricity	330	2	–	2	–
Engineering and Society	322	1	–	1	–
Engineering Problems and Drawing	277	–	3	–	10
English	610	1	–	1	–
Mechanical and Thermal Measurements	448	1	–	1	–
Physical Training	640	–	2	–	2
Practical Experience	692	–	–	–	–
Statics	20	1	1	2	1
Surveying	710, 712	1	3	–	–

Second Year Subjects Course 3	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Calculus	491	2	–	2	–
Descriptive Geometry	272	1	–	1	–
Direct Current Machines	338	–	–	2	3
Dynamics	22	1	–	1	–
Economics	311	2	–	2	–
Elecrricity	332, 334	2	3	–	–
Engineering Chemistry	226	1	–	1	–
Engineering Problems and Drawing	286	–	8	–	12
Heat Engines, Elementary	420	1	–	1	–
Hydraulics, Elementary	447	1	–	–	–
Mechanical Engineering	461	2	–	–	–
Mechanics of Materials	23, 31	2	3	2	–
Physical Training	640	–	2	–	2
Practical Experience	692	–	–	–	–
Theory of Machines A	465	2	–	2	–
Treatment of Technical Data	449	–	–	2	–

Third Year Subjects Course 3	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Alrernating Current Machinery	345	–	–	2	–
Alternating Currents	340	2	–	–	–
Business	310	–	–	1	–
Electrical Laboratory	346	–	3	–	3
Elementary Structural Engineering	29, 293	1	3	1	3
Heat Engineering	422	2	–	2	–
Heat Engines, Theory	421, 423	2	3	2	3
Hydraulics	440, 441	2	–	2	3
Machine Design	467, 468	2	9	2	6
Modern World History	324	1	–	1	–
Physical Metallurgy	532	1	–	1	–
Political Science	323	1	–	1	–
Practical Experience	692	–	–	–	–
Theory of Machines B	466	2	–	–	–

Fourth Year Subjects Course 3	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Engineering Economics	313	–	–	1	–
Engineering Law	314	1	–	–	–
Heat Engine Laboratory	426	–	5	–	5
Heat Power Engineering	424	2	–	2	–
Physical Metallurgy II	547, 548	1	–	1	1½
Hydraulics	442, 443, 444	2	5	3	6
Industrial Management	318	1	–	1	–
Internal Combustion and Air-Craft Engines	425	1	–	1	–
Machine Design	473, 474	2	5	2	6
Modern Political and Economic Trends	325	1	–	1	–
Philosophy of Science	326	1	–	½	–
Practical Experience	692	–	–	–	–
Profession of Engineering	327	–	–	½	–
Structural Engineering	46, 300	2	3	–	–
Thesis	732	–	1	–	1

ENGINEERING PHYSICS

(COURSE 5)

Admission to and promotion in this course is granted only to students who meet the special requirements set forth on pages 25 and 142 of this Calendar.

The course is designed to afford a training in Mathematics and Physics beyond that which it is possible to give in the other undergraduate courses in engineering. It is believed that a wider and more horough acquaintance with the basic sciences will bring to the student a readier appreciation of the nature of the technical problems with which he will later be confronted and a greater facility in the solution of them. A course of the kind offered should consequently be of particular value to those who desire to enter governmental or industrial research laboratories, or who wish to engage in any original work of investigation or development in the field of applied physics.

Throughout the four years of the course an effort is made to maintain the practical point of view in the theoretical instruction. This is effected, in part, by adopting wherever possible the engineering viewpoint in the teaching of mathematical and scientific subjects, and, in part, by the inclusion of certain basic engineering instruction.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Algebra and Calculus, 502, page 124.

FIRST YEAR SUBJECTS COURSE 5	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Algebra and Calculus	502	$3\frac{1}{2}$	–	$3\frac{1}{2}$	–
Analytical Geometry	503	$1\frac{1}{2}$	–	$1\frac{1}{2}$	–
Applied Mechanics	24	2	–	2	–
Chemistry	221, 222	2	–	2	6
Descriptive Geometry	270	1	–	1	–
Electricity	330	2	–	2	–
Engineering and Society	322	1	–	1	–
Engineering Problems and Drawing	279	–	6	–	3
English	610	1	–	1	–
Physical Training	640	–	2	–	2
Properties of Matter, Mechanics and Heat	650, 651	4	3	4	3
Surveying	710, 712	1	3	–	–

Second Year Subjects Course 5	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Acoustics	654	1	–	–	–
Analytical Geometry of Space	506	1	–	1	–
Differential Calculus	504	3	–	3	–
Dynamics	25	1	–	1	–
Economics	311	2	–	2	–
Electric Circuits	354, 356	2	$1\frac{1}{2}$	2	$1\frac{1}{2}$
Elementary Light	653	1	–	1	–
Elementary Magnetism and Electricity	652	1	–	2	–
Integral Calculus and Differential Equations	505	3	–	3	–
Mathematical Problems	495	–	3	–	3
Mechanics of Materials	23, 31	2	–	2	3
Organic Chemistry	250	1	–	1	–
Physics Laboratory	655	–	6	–	3
Physical Training	640	–	2	–	2

Students in Engineering Physics are required to state at the beginning of the Third Year the options they desire to pursue in the Third and Fourth Years. Permission to enter upon an option must be sought from the Council. This may be withheld if the number of students offering, or conditions existing at the time, render it impracticable to give this work.

THIRD YEAR SUBJECTS COURSE 5	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Alternating Currents (1949-50 only)	341	3	–	–	–
Differential Equations	509	1	1	1	1
Electronics	366, 379	2	–	2	3
Heat	658	1	–	1	–
Machine Design	471, 472	1	3	1	3
Mathematical Methods in Physics I	656	1	–	1	–
Modern World History	324	1	–	1	–
Physical Laboratory	659	–	3	–	3
Physical Metallurgy	549	1	–	1	–
Political Science	323	1	–	1	–
Properties of Matter	657	2	–	2	–
Theoretical Mechanics	520	1	1	1	1
Theory of Functions	508	1	1	1	1

And *one* of the following options which must be continued in the Fourth Year.

Option 5e, Electricity					
Electrical Machines	377, 378	2	3	2	3
Theory of Potential	667	1	–	1	–
Option 5s, X-Rays and Spectroscopy					
Option 5i, Illumination and Acoustics					
Electrical Machines	377, 378	2	3	2	3
Geometrical Optics	660, 661	1	3	1	–
Option 5g, Geophysics					
General Geology	388	–	–	3	–
Lithology	585	1	–	–	1
Mineralogy, Elementary	580, 581	2	1	–	–
Option 5t, Thermodynamics					
Hydraulics	450	1	–	1	–
Theory of Heat Engines	421, 423	2	3	2	3

Fourth Year Subjects Course 5	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Option 5e, Electricity					
Acoustics	97	2	–	–	–
Atomic Physics	663	2	–	2	–
Circuit Analysis	351	2	–	2	–
Communications I	360, 361	3	3	–	–
Communications II	362, 363	–	–	3	3
Differential Equations of Mathematical Physics	521	2	–	2	–
Engineering Electronics	357, 358	2	1½	2	1½
Transmission at Low and High Frequency	352	2	–	–	–
Electromagnetic Theory, Applied	365	2	–	2	–
Mathematical Methods in Physics II	664	2	–	2	–
Modern Political and Economic Trends	325	1	–	1	–
Operational Methods	364	2	–	2	–
Philosophy of Science	326	1	–	½	–
Physical Laboratory	665	–	3	–	3
Profession of Engineering	327	–	–	½	–
Thesis Seminar	733	–	–	1	–
Ultra-High Frequency Communication	371, 372	–	–	2	1½
Option 5s, X-Rays and Spectroscopy					
Analysis of Materials by Spectrographic and X-Ray Methods	669	1	–	1	–
Atomic Physics	663	2	–	2	–
Communications I	360, 361	3	3	–	–
Differential Equations of Mathematical Physics	521	2	–	2	–
Electromagnetic Theory, Applied	365	2	–	2	–
Mathematical Methods in Physics II	664	2	–	2	–
Modern Political and Economic Trends	325	1	–	1	–
Morphological Crystallography	598	1	–	1	–

FOURTH YEAR SUBJECTS COURSE 5	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Option 5i, Illumination and Acoustics					
Architectural Acoustics	89, 90	2	3	2	6
Atomic Physics	663	2	–	2	–
Communications I	360, 361	3	3	–	–
Differential Equations of Mathematical Physics	521	2	–	2	–
Mathematical Methods in Physics II	664	2	–	2	–
Modern Political and Economic Trends	325	1	–	1	–
Operational Methods	364	2	–	2	–
Philosophy of Science	326	1	–	½	–
Photometry and Illumination Design	95, 96	2	3	2	6
Physical Laboratory	674	–	3	–	3
Profession of Engineering	327	–	–	½	–
Thesis Seminar	733	–	–	1	–
Option 5t, Thermodynamics					
Alternating Current Machinery	353, 367	3	3	1	–
Differential Equations of Mathematical Physics	521	2	–	2	–
Electronics	337, 368	–	–	3	3
Heat Engineering Laboratory	426	–	6	–	6
Heat Power Engineering	424	2	–	2	–
Heat Transfer and Refrigeration	429	2	–	2	–
Hydraulics	450	1	–	1	–
Internal Combustion Engines	425	1	–	1	–
Low Temperature Physiology	211, 212	1	3	1	3
Machine Design	478	1	–	1	–
Modern Political and Economic Trends	325	1	–	1	–
Philosophy of Science	326	1	–	½	–
Profession of Engineering	327	–	–	½	–
Thesis Seminar	733	–	–	1	–
Vibration Engineering	99, 100	1	3	1	3

Fourth Year Subjects Course 5	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Option 5s, X-Rays and Spectroscopy (continued)					
Operational Methods	364	2	–	2	–
Optics, Advanced	666	–	–	2	–
Philosophy of Science	326	1	–	½	–
Physical Laboratory	665	–	9	–	12
Profession of Engineering	327	–	–	½	–
Thesis Seminar	733	–	–	1	–
Option 5g, Geophysics					
Differential Equations of Mathematical Physics	521	2	–	2	–
Economic Geology	398	1	–	3	–
Electromagnetic Theory, Applied	365	2	–	2	–
Electronics	676	–	3	–	3
Geophysics	670, 672	2	6	2	6
Location of Mineral Deposits	401	1	–	1	–
Modern Political and Economic Trends	325	1	–	1	–
Petrography	594, 595	2	2	2	2
Philosophy of Science	326	1	–	½	–
Physics of the Earth	675	2	–	2	–
Profession of Engineering	327	–	–	½	–
Structural Geology	390, 391	1	3	1	3
Thesis Seminar	733	–	–	1	–

CHEMICAL ENGINEERING AND APPLIED CHEMISTRY

(Course 6)

The chemical engineer is concerned with the development and operation of processes by means of which matter is chemically altered to a more useful form, and in the design, construction, operation and management of plant in which to effect such changes. Apart from such obviously chemical processes as those concerned with the production of acids, alkalis, salts, petroleum, rubber products, pulp and paper, explosives, paints and varnishes, soap, plastics, etc., there are many industrial processes where chemistry plays a part, or where a knowledge of chemistry is valuable. There is thus a wide field of endeavour for the chemical engineer. In order to equip a student to enter this field, the course in chemical engineering is intended to provide the student with training in the principles of the major divisions of chemistry and chemical engineering, together with an understanding of such other engineering subjects as thermodynamics, hydraulics, electricity, mechanics of materials, and machine design.

As part of the work of the Fourth Year each student is assigned a problem involving original investigation, in order to let him apply to some extent what he has learned, and to introduce him to the chemical litertaure. It also serves as an introduction to research for those who are attracted to it, and who, because of their basic training are equipped to carry on research in chemistry or chemical engineering at the graduate level or in laboratories outside the university.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Analytical Geometry, 492, page 123.

GRADUATE STUDY

Graduates of this University, or of another university of comparable standing, who have taken the above course, or one similar, with a sufficiently good standing may proceed with work leading to a graduate degree.

Students wishing to pursue further studies, may proceed in the Department of Chemical Engineering to the degrees of M.A.Sc. and Ph.D.

The major portion of the student's time will be devoted to research work assigned by the Department, but certain specified courses of instruction must be taken in which examinations are demanded.

Further information appears on page 213 of this Calendar. The Calendar of the School of Graduate Studies should be consulted for details.

First Year Subjects Course 6	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry	492	1	–	2	–
Calculus	490	2	–	2	–
Chemistry	221, 222	2	9	2	6
Descriptive Geometry	270	1	–	1	–
Dynamics	21	1	–	2	–
Electricity	330	2	–	2	–
Engineering and Society	322	1	–	1	–
Engineering Problems and Drawing	280	–	4	–	8
English	610	1	–	1	–
Mechanical and Thermal Measurements	448	1	–	1	–
Mineralogy, Introductory	583	–	–	1	1
Physical Training	640	–	2	–	2
Statics	20	1	–	2	–
Surveying	710, 712	1	3	–	–

Second Year Subjects Course 6	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Calculus	491	2	–	2	–
Chemical Laboratory	229	–	–	–	–
Economics	311	2	–	2	–
Electricity	332, 334	2	3	–	–
Elementary Machine Design	462	–	–	2	–
Engineering Problems and Drawing	287	–	3	–	6
German	613	1	–	1	–
Hydraulics, Elementary	447	1	–	–	–
Industrial Chemistry	230, 232	1	11	2	–

SECOND YEAR SUBJECTS COURSE 6—*Continued*	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Inorganic Chemistry	223	1	–	1	–
Mechanics of Materials	23	2	–	2	–
Organic Chemistry	234, 235	2	–	2	10
Physical Chemistry	236	2	–	2	–
Physical Training	640	–	2	–	2

THIRD YEAR SUBJECTS COURSE 6	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Alternating Currents	340, 349	2	3	–	–
Business	310	–	–	1	–
Chemical Engineering	242	2	–	–	–
Chemical Theory	240	–	–	2	–
Electrochemistry	246, 247	1½	1½	–	–
German	614	1	–	1	–
Heat Engines, Theory	421, 428	2	–	2	1½
Hydraulics	440, 441	2	1½	2	–
Industrial Chemistry	241, 238	1	–	1	13½
Modern World History	324	1	–	1	–
Optics	72, 73	1	–	1	3
Organic Chemistry	244, 245	2	10½	2	–
Political Science	323	1	–	1	–

Fourth Year Subjects Course 6	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Chemical Engineering	253	1	–	1	–
Chemical Engineering Problems	252	–	–	–	2
Chemical Engineering Thermodynamics	248	1	–	1	–
Chemical Laboratory	251	–	15	–	–
Chemical Theory	259	1	–	1	–
Engineering Law	314	1	–	–	–
German	615	1	–	1	–
Graphical Methods in Chemical Engineering	254	–	1	–	1
Industrial Chemistry	258	1	–	–	–
Industrial Management	318	1	–	1	–
Machine Design	469, 470	1	–	1	3
Modern Political and Economic Trends	325	1	–	1	–
Organic Chemistry	249	1	–	1	–
Philosophy of Science	326	1	–	½	–
Profession of Engineering	327	–	–	½	–
Public Speaking	319	1	–	1	–
Thesis	734	–	5	–	16

ELECTRICAL ENGINEERING

(COURSE 7)

In following his profession, an electrical engineer will find necessary a knowledge of many fields in addition to that of applying things electrical for the benefit of humanity. For this reason the course includes not only mathematics, mechanics, physics and chemistry, but also heat engines, hydraulics, theory of mechanisms, machine design, business, economics, engineering law, and other non-electrical subjects.

In the electrical field much time is given to the calculation of circuits of electric, magnetic, and dielectric types, methods of measurement of various quantities in direct and alternating current circuits, theory of generators, motors, magnets, and other apparatus, design, electrical transmission of energy, and many related matters of interest. A great variety of problems for solution is one means of developing understanding. In the Fourth Year the proportion of time given to electrical engineering is much greater than in earlier years.

A training of this nature should, with subsequent experience, enable a student to develop into a useful and valued member of the profession, whether his natural abilities lead him into technical, commercial, or administrative responsibilities.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Analytical Geometry, 492, page 123.

PRACTICAL EXPERIENCE

Before receiving the degree, every student in Electrical Engineering is required to submit satisfactory evidence of having had 1200 hours' practical experience. (See subject 695.)

GRADUATE STUDY

Graduates of this University, or of another university of recognized standing, who have taken the above course, or one similar, and who have a satisfactory academic record may proceed with work leading to a graduate degree.

About one-half of the time will be devoted to subjects chosen from mathematics, physics, and the fundamentals of electrical engineering. The other half may be devoted to power, electronics, or communications.

Further information appears on page 213. The Calendar of the School of Graduate Studies should be consulted for details.

First Year Subjects Course 7	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry	492	1	1	2	1
Calculus	490	2	2	2	2
Chemistry	221, 222	2	–	2	6
Descriptive Geometry	270	1	–	1	–
Dynamics	21, 281	1	1	2	1
Electricity	330	2	–	2	–
Engineering and Society	322	1	–	1	–
Engineering Problems and Drawing	281	–	9	–	4
English	610	1	–	1	–
Mechanical and Thermal Measurements	448	1	–	1	–
Physical Training	640	–	2	–	2
Practical Experience	695	–	–	–	–
Statics	20, 281	1	1	2	1
Surveying	710, 712	1	3	–	–

Second Year Subjects Course 7	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Applied Physics	70, 71	1	3	1	3
Calculus	491	2	3	2	3
Descriptive Geometry	272	1	–	1	–
Dynamics	22	1	–	1	–
Economics	311	2	–	2	–
Electrical Fundamentals	333	2	–	2	–
Electrical Laboratory	334	–	–	–	6
Electricity	332	–	–	2	–
Elementary Heat Engines	420	1	–	–	–
Elementary Machine Design	462	–	–	2	–
Engineering Chemistry	226	1	–	1	–
Engineering Problems and Drawing	288	–	6	–	3
Hydraulics, Elementary	447	1	–	–	–
Mechanics of Materials	23, 31	2	3	2	–
Physical Training	640	–	2	–	2
Practical Experience	695	–	–	–	–

Third Year Subjects Course 7	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Alternating Currents	341	2	–	2	–
Business	310	–	–	1	–
Direct Current Machines	339	2	–	–	–
Electrical Design	342, 343	2	4	–	–
Electrical Problems and Seminar	335	–	2	–	2
Electrical Laboratory	344	–	6	–	3
Electronics	337	–	–	3	–
Heat Engines, Theory	421, 423	2	3	2	–
Hydraulics	440, 441	2	–	2	3
Machine Design	475, 468	2	–	2	3
Mathematical Application in Electricity Engineering	336	–	–	3	–
Modern World History	324	1	–	1	–
Physical Metallurgy	549	1	–	1	–
Political Science	323	1	–	1	–
Practical Experience	695	–	–	–	–

Fourth Year Subjects Course 7	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Alternating-Current Machinery I	353	3	–	1	–
Circuit Analysis	351	2	–	3	–
Communications I	360, 361	3	3	–	–
Electrical Laboratory	355	–	4½	–	1½
Electrical Problems and Seminar	359	–	2	–	2
Engineering Economics	313	–	–	1	–
Engineering Electronics	357, 358	2	1½	1	1½
Engineering Law	314	1	–	–	–
Industrial Management	318	1	–	1	–
Modern Political and Economic Trends	325	1	–	1	–
Philosophy of Science	326	1	–	½	–
Practical Experience	695	–	–	–	–
Profession of Engineering	327	–	–	½	–
Thesis	735	–	–	–	–
Transmission at Low and High Frequencies	352	2	–	2	–
*And at least three of the following subjects, one of which must be either Communications II or Alternating Current Machinery II:**					
Acoustics	82, 83	–	–	2	1½
Alternating-Current Machinery II	369, 370	–	–	2	1½
Communications II	362, 363	–	–	3	3
Electrical Design	373, 374	–	–	2	2
Illumination	93, 94	–	–	2	3
Ultra-High Frequency Communications	371, 372	–	–	2	1½

*Due to overcrowded facilities, it may be necessary, during the session 1949-50, to restrict the choice of elective subjects to certain groupings.

METALLURGICAL ENGINEERING

(COURSE 8)

The metallurgical engineer is concerned with the winning of metals from ores. Since virgin metals rarely possess useful physical properties, the second task of the metallurgist is to produce alloys, such as steel, which have suitable physical properties.

No other materials approach the metals in strength, and the whole fabric of modern civilization is dependent on their properties. The fields of employment for graduates lie in production metallurgical industries, the industries which fabricate metals, and in sales and research. Metallurgical research facilities have notably been increased in recent years in Canada.

The course is designed to give the student a firm grasp of the chemical fundamentals upon which metallurgical reactions are based, and of the physical principles underlying the structure and properties of alloys. Engineering courses are provided to give a general knowledge of hydraulics, mechanics of materials, etc.

Courses in production metallurgy cover the theory and practice of winning aluminium, copper, iron, lead, magnesium, nickel, zinc, etc., from their ores. Physical Metallurgy courses cover the structure and properties of alloys, including microscopic, x-ray and mechanical methods of investigation.

The subjects of instruction are shown in the following tables. In these tables, reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Analytical Geometry 492, page 123.

GRADUATE STUDY

Graduates of this University, or of another university of comparable standing, who have taken the above course, or one similar, with a sufficiently good standing, may proceed with work leading to a graduate degree.

Students wishing to pursue further studies, whether in extractive metallurgy or physical metallurgy, may proceed in the Department of Metallurgical Engineering to the degrees M.A.Sc. and Ph.D.

A major part of the time will be spent on research work, while the remainder will be devoted to subjects chosen from Physics, Chemistry, Mining, Mineralogy and Metallurgy.

Further information appears on page 213 and in the Calendar of the School of Graduate Studies.

First Year Subjects Course 8	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry	492	1	–	2	–
Calculus	490	2	–	2	–
Chemistry	221, 222	2	3	2	3
Descriptive Geometry	270	1	–	1	–
Dynamics	21	1	–	2	–
Electricity	330	2	–	2	–
Engineering and Society	322	1	–	1	–
Engineering Problems and Drawing	282	–	3	–	6
English	610	1	–	1	–
Physical Training	640	–	2	–	2
Properties of Matter, Mechanics and Heat	650, 651	4	3	4	3
Statics	20	1	–	2	–
Surveying	710, 712	1	3	–	–

Second Year Subjects Course 8	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Alternating Currents	331, 350	1	–	1	3
Analytical Chemistry Laboratory	228	–	6	–	6
Calculus	491	2	–	2	–
Economics	311	2	–	2	–
Electricity	332, 334	2	3	–	–
Elementary Machine Design	462	–	–	2	–
Engineering Problems and Drawing	289	–	3	–	3
Fuels and Combustion	531	1	–	1	–
Hydraulics, Elementary	447	1	–	–	–
Inorganic Chemistry	223	1	–	1	–
Mechanics of Materials	23	2	–	2	–
Metallurgy	530	1	–	1	–
Mining	167	1	–	1	–
Optics	77, 78	1	3	1	3
Physical Chemistry	236	2	–	2	–
Physical Training	640	–	2	–	2

Third Year Subjects Course 8	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Chemistry	225	1	–	1	–
Assaying	160, 161	1	3	1	3
Business	310	–	–	1	–
Electrical Machinery	348	2	–	–	–
Electrochemistry	246, 247	$1\frac{1}{2}$	3	–	–
Heat Engines, Theory	427, 428	1	–	1	$1\frac{1}{2}$
Metallurgical Theory	239	2	–	2	–
Modern World History	324	1	–	1	–
Ore Dressing	181, 182	–	–	2	6
Political Science	323	1	–	1	–
Principles of Metallurgical Engineering	534, 535	2	6	1	6
Principles of Physical Metallurgy	536, 537	2	3	2	3
Principles of Mineral Dressing	180	2	–	–	–
Refractories in Metallurgy	573	1	–	1	–

Fourth Year Subjects Course 8	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Engineering Economics	313	–	–	1	–
Ferrous Production Metallurgy	552	1	–	1	–
Machine Design	469, 470	1	–	1	3
Metallurgical Theory	550	1	–	1	–
Metallurgy Problems	540	2	–	2	–
Modern Political and Economic Trends	325	1	–	1	–
Non-Ferrous Production Metallurgy	541, 542	2	6	2	3
Ore Dressing	183, 184	1	6	1	–
Philosophy of Science	326	1	–	$\frac{1}{2}$	–
Physical Metallurgy	543, 544	2	6	2	3
Plant Management	317	–	–	1	–
Profession of Engineering	327	–	–	$\frac{1}{2}$	–
Thesis	736	–	4	–	11

CERAMIC ENGINEERING

(Course 8a)

The course in Ceramics offers a training for those who intend to work as engineers in the ceramic and industrial mineral industries. Ceramics deals with the preparation of raw materials for, and the manufacture and use of, such products as refractories, cement, heavy clay products, porcelain, pottery, glass and enamelled iron. Industrial mineral engineering includes the beneficiation and commercial utilization of minerals, not primarily used for the production of metals. Such minerals include asbestos, clay, diatomite, feldspar, gypsum, limestone, mica, quartz, talc, etc.

In the manufacture of fused silicates, such as glasses, glazes and enamels, both clear and coloured and in the manufacture of special bodies such as those used for thermal and electrical insulation, practically every chemical element obtainable on a commercial basis may be used. The subject matter is essentially inorganic chemical engineering with an emphasis upon high temperature chemistry. The natural field of employment for graduates would be for the technical, production, sales and research divisions of the industry.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Analytical Geometry 492, page 123.

GRADUATE STUDY

Graduates of this University, or of another university of comparable standing, who have taken the above course, or one similar, with a sufficiently good standing, may proceed with work leading to a graduate degree. A part of the time will be devoted to subjects chosen from physics, chemistry and others approved by the School of Graduate Studies, while the remainder will be devoted to research in the same phase of the ceramic field.

Further information appears on page 213. The Calendar of the School of Graduate Studies should be consulted for further details.

First Year Subjects Course 8a	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry	492	1	–	2	–
Calculus	490	2	–	2	–
Chemistry	221, 222	2	3	2	3
Descriptive Geometry	270	1	–	1	–
Dynamics	21	1	–	2	–
Electricity	330	2	–	2	–
Engineering and Society	322	1	–	1	–
Engineering Problems and Drawing	282	–	3	–	6
English	610	1	–	1	–
Mineralogy, Introductory	583	–	–	1	1
Physical Training	640	–	2	–	2
Properties of Matter, Mechanics and Heat	650, 651	4	3	4	3
Statics	20	1	–	2	–
Surveying	710, 712	1	3	–	–

Second Year Subjects Course 8a	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Chemical Laboratory	228	–	6	–	6
Ceramics, Introductory	572	2	–	–	–
Economics	311	2	–	2	–
Elementary Machine Design	462	–	–	2	–
Electricity	332, 334	2	3	–	–
Engineering Problems and Drawing	290	–	3	–	6
Fuels and Combustion	531	1	–	1	–
Hydraulics, Elementary	447	1	–	–	–
Industrial Chemistry	230	1	–	2	–
Inorganic Chemistry	223	1	–	1	–
Mechanics of Materials	23	2	–	2	–
Optics	77, 78	1	3	1	3
Organic Chemistry	250	1	–	1	–
Physical Chemistry	236	2	–	2	–
Physical Training	640	–	2	–	2

Third Year Subjects Course 8a	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Alternating Currents	340, 349	2	3	–	–
Assaying Laboratory	162	–	1½	–	–
Business	310	–	–	1	–
Ceramic Minerals and Calculations	560	4	–	2	–
Ceramics	562	–	–	2	–
Ceramics Laboratory	564	–	6½	–	7
Chemical Engineering	242	2	–	–	–
Chemical Theory	240	–	–	2	–
Elementary Structural Engineering	29	1	–	1	–
Engineering Problems and Drawing	297	–	3	–	3
Heat Engines, Theory	421, 428	2	–	2	1½
Heavy Clay Products Laboratory	561	–	5	–	7
Modern World History	324	1	–	1	–
Optical Mineralogy, Elementary	589	–	–	1	–
Physical Metallurgy	549	1	–	1	–
Political Science	323	1	–	1	–

Fourth Year Subjects Course 8a	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Economic Geology	402	–	–	2	–
Glass and Enamels	566	1	–	1	–
Hydraulics	440, 441	2	3	–	–
Industrial Management	318	1	–	1	–
Machine Design	469, 470	1	–	1	3
Modern Political and Economic Trends	325	1	–	1	–
Optical Mineralogy Laboratory	596	–	2	–	–
Ore Dressing Laboratory	185	–	3	–	3
Philosophy of Science	326	1	–	$\frac{1}{2}$	–
Principles of Mineral Dressing	180	2	–	–	–
Profession of Engineering	327	–	–	$\frac{1}{2}$	–
Refractories and Ceramic Bodies	565	2	–	1	–
Thesis	737	–	8	–	13
Whitewares and Enamels Laboratory	568	–	6	–	6

MINING GEOLOGY

(COURSE 9)

The course in Mining Geology is designed to train more particularly those who wish to enter the field of applied geology, but it is sufficiently broad to provide training for work in any branch of geology, unless it be that in which an extensive knowledge of palaeontology is necessary.

The economic geologist is frequently brought into contact with engineering problems and it is essential that he receive a good grounding in those subjects, such as mathematics, mechanics, chemistry, physical sciences, surveying, and engineering drawing, that constitute the preliminary work in engineering courses. It is necessary that he understand something of the language and methods of the mining, metallurgical, and construction engineer with whom he must co-operate in his work around mines, dams, and other engineering works. The first two years of this course are the same as those in Mining Engineering, since that course provides the essential preliminary work, and some mining and metallurgy are taken in the other years to broaden the knowledge of the geologist in the work of those with whom he must co-operate.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Analytical Geometry, 492, page 123.

PRACTICAL EXPERIENCE

Before receiving the degree every student in Mining Geology, is required to submit satisfactory evidence of having had six months' practical experience. (See subject 696.)

GRADUATE STUDY

Graduates in the above course, or in a similar one in any university with standards comparable to this University, with a sufficiently good standing, may proceed with work leading to a higher degree.

Work for such degree will include the preparation of a thesis on an approved subject, together with the study of such subjects as advanced structural geology, economic geology, mining, metamorphism, and geophysics.

Further information appears on page 213. The Calendar of the School of Graduate Studies should be consulted for details.

First Year Subjects Course 9	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry	492	1	–	2	–
Calculus	490	2	–	2	–
Chemistry	221, 222	2	6	2	6
Descriptive Geometry	270	1	–	1	–
Dynamics	21	1	–	2	–
Electricity	330	2	–	2	–
Engineering and Society	322	1	–	1	–
Engineering Problems and Drawing	276	–	6	–	6
English	610	1	–	1	–
General Geology	388	–	–	3	–
Mechanical and Thermal Measurements	448	1	–	1	–
Mining Laboratory	165	–	–	–	2
Physical Training	640	–	2	–	2
Practical Experience	696	–	–	–	–
Statics	20	1	–	2	–
Surveying	710, 712	1	3	–	–

Second Year Subjects Course 9	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Alternating Currents	331, 350	1	–	1	3
Analytical Chemistry Laboratory	227	–	–	–	3
Chemistry	224	1	–	1	–
Descriptive Geometry	272	1	–	1	–
Economics	311	2	–	2	–
Engineering Problems and Drawing	285	–	8	–	8
Heat Engines, Elementary	420	1	–	–	–
Lithology	585	1	–	–	–
Mechanics of Materials	23, 31	2	–	2	1
Mineralogy, Determinative	587	–	2	–	3
Mineralogy, Elementary	580, 581	2	1	–	–

Second Year Subjects Course 9—*Continued*	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Mining	166	1	–	–	–
Optical Mineralogy, Elementary	589	–	–	1	–
Physical Training	640	–	2	–	2
Practical Experience	696	–	–	–	–
Problems and Seminar	193	–	2	–	–
Surveying	715, 717	1	6	1	–
Theory of Measurements	190	1	–	–	–

Third Year Subjects Course 9	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Chemistry	225, 237	1	4	1	3
Assaying	160, 161	1	3	1	3
Business	310	–	–	1	–
Economic Geology	398, 400	2	3	2	3
Geological Field Work	380	–	–	–	–
Historical Geology	383, 384	2	2	2	2
Metallurgy	530	1	–	–	–
Mining	168	1	–	1	–
Modern World History	324	1	–	1	–
Petrography	594, 595	1	2	1	2
Physical Chemistry	236	2	–	2	–
Political Science	323	1	–	1	–
Practical Experience	696	–	–	–	–
Precambrian and Economic Geology Laboratory	397	–	–	–	2
Principles of Mineral Dressing	180	2	–	–	–
Structural Geology	390, 391	1	3	1	3
Survey Camp	720	–	–	–	–

Fourth Year Subjects Course 9	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Engineering Economics	313	–	–	1	–
Geology of Canada	403, 404	2	–	1	2
Geology, Mining	393, 394	2	3	1	3
Geology, Pleistocene and Physiographic	381, 382	1	1	1	–
Geology, Precambrian	392	2	–	–	–
Geophysics	671, 673	1	3	1	3
Mine Management	171	2	–	–	–
Mineralography Laboratory	597	–	2	–	2
Mining	170, 172	–	–	2	6
Modern Political and Economic Trends	325	1	–	1	–
Optical Mineralogy Laboratory	596	–	2	–	–
Petroleum and Ground Water Geology	406, 407	1	3	2	–
Practical Experience	696	–	–	–	–
Profession of Engineering	327	–	–	½	–
Philosophy of Science	326	1	–	½	–
Physical Metallurgy	549	1	–	1	–
Thesis	738	–	4	–	6

AERONAUTICAL ENGINEERING

(Course 10)

Admission to and promotion in this course is granted only to students who meet the special requirements set forth on pages 26 and 142 of this Calendar.

The course is designed to provide a sound training in mathematics and science in the First and Second Years, together with certain fundamental subjects pertaining to the practice of aeronautical engineering. In the Third and Fourth Years, training is provided in those subjects now generally recognized as belonging strictly to the design, construction, and operation of aircraft.

The training in this course is planned to fit graduates to enter the technical design staffs of aircraft manufacturing companies. In Canada, Great Britain and the United States, due to the necessary emphasis on mass production for war purposes, there is a shortage of personnel training to enter design staffs. In these countries there will be opportunities for graduates in Aeronautical Engineering.

Students desiring to enter the Third Year of this course must have had at least two hours of instructional flying.

The subjects of instruction are shown in the following tables. In these tables reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Algebra and Calculus, 502, page 124.

GRADUATE STUDY

Graduates of this University, or of other Universities of comparable standing, who have taken the above mentioned or similar course with sufficiently high records may proceed with work leading to a graduate degree.

The time devoted to graduate study is divided between work on the subjects of mathematics, aerodynamics, and related subjects to the approved field of investigation chosen by the candidate.

Further information appears on page 213. The Calendar of the School of Graduate Studies should be consulted for details.

First Year Subjects Course 10	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Algebra and Calculus	502	$3\frac{1}{2}$	–	$3\frac{1}{2}$	–
Analytical Geometry	503	$1\frac{1}{2}$	–	$1\frac{1}{2}$	–
Applied Mechanics	24	2	–	2	–
Chemistry	221, 222	2	–	2	6
Descriptive Geometry	270	1	–	1	–
Electricity	330	2	–	2	–
Engineering and Society	322	1	–	1	–
Engineering Problems and Drawing	279	–	3	–	6
English	610	1	–	1	–
Physical Training	640	–	2	–	2
Properties of Matter; Mechanics and Heat	650, 651	4	3	4	3
Surveying	710, 712	1	3	–	–

Second Year Subjects Course 10	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Acoustics	654	1	–	–	–
Aeronautics	1	1	–	1	–
Analytical Geometry of Space	506	1	–	1	–
Descriptive Geometry	272	1	–	1	–
Differential Calculus	504	3	–	3	–
Dynamics	25	1	–	1	–
Economics	311	2	–	2	–
Elementary Light	653	1	–	1	–
Elementary Magnetism and Electricity	652	1	–	2	–
Engineering Problems and Drawing	286	–	3	–	3
Heat Engines, Elementary	420	1	–	–	–
Integral Calculus and Differential Equations	505	3	–	3	–
Mathematical Problems	495	–	3	–	3
Mechanics of Materials	23, 31	2	–	2	3
Physical Training	640	–	2	–	2
Physics Laboratory	655	–	3	–	6
Theory of Machines A	465	2	–	2	–

Third Year Subjects Course 10	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Advanced Engineering Mechanics	27	1	–	1	–
Aircraft Layout	12	–	–	–	3
Airplane Stress Analysis	9, 10	1	3	1	3
Applied Elasticity	33	1	–	1	–
Differential Equations	509	1	1	1	1
Electrical Engineering	375, 376	2	3	2	3
Elementary Structural Engineering	29	1	–	1	–
Heat Engines, Theory	421, 423	2	3	2	3
Fluid Mechanics	34	1	–	1	–
Machine Design	467, 468	2	3	2	6
Modern World History	324	1	–	1	–
Political Science	323	1	–	1	–
Theory of Functions	508	1	1	1	1

Fourth Year Subjects Course 10	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Aircraft Hydraulics	452	1	–	–	–
Aircraft Propulsion	11	1	–	1	–
Airplane Design and Layout	5, 6	2	9	2	9
Airplane Stress Analysis	7, 8	2	3	2	3
Applied Aerodynamics	3, 4	2	6	2	6
Differential Equations of Mathematical Physics	521	2	–	2	–
Gas Dynamics	26	2	–	2	–
Modern Political and Economic Trends	325	1	–	1	–
Philosophy of Science	326	1	–	$\frac{1}{2}$	–
Physical Metallurgy	549	1	–	1	–
Profession of Engineering	327	–	–	$\frac{1}{2}$	–
Thesis	739	–	–	–	–

ENGINEERING AND BUSINESS

(COURSE 11)

A substantial proportion of those whoare admitted to the Faculty of Applied Science and Engineering have no particular interest in any one branch of technology, but desire a broad general training, preponderantly engineering in character, that will fit them rather for executive or administrative positions, than for those of a purely technical or design nature. Many engineers nowadays occupy positions of responsibility in sales, production. purchasing, and other similar branches of industry, and for those who wish to enter such fields, the training offered should contain a greater proportion of economic, business, and management instruction than is possible in the distinctively technical courses.

The course in Engineering and Business is designed to cover that field and to be suitable for those who require such training. It is not expected that graduates from this course will immediately enter upon executive work; indeed, their early work may be almost entirely of a technical character, but it is anticipated that their ultimate tendency will be toward positions in the field of management or business. Their progress in that direction will depend largely on their own industry and abilities. Moreover, all engineers, whatever their duties may be, must be able to handle men as well as machines and their duties tend to become more and more administrative in character as they assume positions of increasing responsibility.

The subjects of instruction are shown in the following tables. In these tables, reference numbers have been assigned to the subjects referring to a more detailed description of each, *e.g.*, Calculus 491, page 123.

Before receiving the degree, every student in Engineering and Business is required to submit satisfactory evidence that he has had practical experience satisfactory to the Committee administering the course.

First Year Subjects Course 11	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Analytical Geometry	492, 277	1	1	2	1
Calculus	490, 277	2	2	2	2
Chemistry	221, 222	2	6	2	–
Descriptive Geometry	270	1	–	1	–
Dynamics	21, 277	1	1	2	1
Electricity	330	2	–	2	–
Engineering and Society	322	1	–	1	–
Engineering Problems and Drawing	277	–	3	–	10
English	610	1	–	1	–
Mechanical and Thermal Measurements	448	1	–	1	–
Physical Training	640	–	2	–	2
Practical Experience	698	–	–	–	–
Statics	20	1	1	2	1
Surveying	710, 712	1	3	–	–

Second Year Subjects Course 11	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Applied Physics	70, 71	1	3	1	3
Calculus	491	2	–	2	–
Descriptive Geometry	272	1	–	1	–
Direct Current Machines	338	–	–	2	3
Dynamics	22	1	–	1	–
Economics	311	2	–	2	–
Electricity	332, 334	2	3	–	–
Engineering Chemistry	226	1	–	1	–
Engineering Problems and Drawing	286	–	6	–	8
Heat Engines, Elementary	420	1	–	1	–
Hydraulics, Elementary	447	1	–	–	–
Industrial Chemistry	230	1	–	1	–
Mechanics of Materials	23, 31	2	3	2	–
Physical Metallurgy	532	–	–	2	–
Physical Training	640	–	2	–	2
Practical Experience	698	–	–	–	–
Public Speaking	320	–	–	–	–

Third Year Subjects Course 11	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Accounting	306	2	1	2	1
Alternating Currents	340, 346	2	3	–	–
Applied Economics	308	2	–	2	2
Elementary Structural Engineering	29	1	–	1	–
Engineering Problems and Drawing	298	–	6	–	3
Heat Engines, Theory	421, 423	2	–	2	3
Hydraulics	440, 441	2	–	2	3
Industrial Management A	321	1	2	2	1
Machine Design	467, 468	2	3	2	3
Modern World History	324	1	–	1	–
Political Science	323	1	–	1	–
Practical Experience	698	–	–	–	–
Statistics	307	2	–	2	–

Fourth Year Subjects Course 11	Subject No.	Hours per week			
		First Term		Second Term	
		Lect.	Lab.	Lect.	Lab.
Alternating Current Machinery	345, 346	–	–	2	3
Business Policy	309	3	2	3	2
Engineering Economics	313	–	–	1	–
Engineering Law	314	1	–	–	–
Industrial Management B	328	2	3	2	3
Industrial Psychology	329	2	–	2	–
Illumination and Acoustics	91, 92	1	1½	1	1½
Manufacturing Processes	476, 477	2	3	2	3
Modern Political and Economic Trends	325	1	–	1	–
Philosophy of Science	326	1	–	½	–
Physical Metallurgy II	547, 548	1	–	1	1½
Practical Experience	698	–	–	–	–
Profession of Engineering	327	–	–	½	–
Structural Engineering	46, 300	2	3	–	–
Thesis	740	–	1	–	1

OUTLINE OF LECTURE AND LABORATORY SUBJECTS

On the pages that follow a brief description is given of the lectures and laboratory subjects prescribed in the preceding tables of curriculum. The numbers before the subjects are the reference numbers assigned in the tables. For example, 20. Statics, means the course of lectures indicated by this number in the table of curriculum for the First Year on page 37.

AERONAUTICAL ENGINEERING

1. Aeronautics. T. R. Loudon.

Course 10, II Year; 1 hr. lecture per week, both terms.

An introductory course on the basic principles of aerodynamics and theory of flight. The elements of stability and control are discussed and the fundamental theory of performance estimation is outlined in these lectures.

Text book: Technical Aerodynamics—K. D. Wood.

3. Applied Aerodynamics. B. Etkin.

Course 10, IV Year; 2 hrs. lectures per week, both terms.

An advanced course in aerodynamic theory, in which the following topics are discussed: performance estimation and calculation, airfoil theory, propellors, wind tunnel corrections, drag, stability and control, spinning, rotary wing aircraft, compressibility effects.

Text books: Applied Aerodynamics—Bairstow. Airfoil and Airscrew Theory—Glauert. Aerodynamics of the Airplane—Millikan. Aerodynamics Theory—Durand.

4. Applied Aerodynamics Laboratory. B. Etkin.

Course 10, IV Year; 6 hrs. laboratory per week, both terms.

This subject is intended to amplify the lecture course on hydrodynamics and aerodynamics. The calibration and practical use of wind tunnel instruments are explained, and experiments are carried out to illustrate the points discussed in the lectures.

5. Airplane Design and Layout. T. R. Loudon, J. W. Jakimiuk, W. H. Jackson, W. Czerwinski.

Course 10, IV Year; 2 hrs. lectures per week, both terms.

The preliminary design of light aircraft is discussed in these lectures. It is intended to give the student a grasp of the principles of balance and load distribution necessary for the design of the various components. About three quarters of these lectures are given in a class room, the remainder being given in the laboratory where practical work is carried out.

Text books: Civil Airworthiness Requirements (British). Civil Aeronautics Manual 04 (U.S.).

6. Airplane Design and Layout Laboratory. T. R. Loudon, W. J. Jakimiuk, W. H. Jackson, W. Czerwinski.

Course 10, IV Year; 9 hrs. laboratory per week, both terms.

This course is divided roughly into three periods devoted respectively to the preliminary design of light aircraft, fitting design and layout and final design of a light aircraft project which is actually constructed under the supervision of skilled aircraft mechanics. The course gives the practical application of the lectures in course 5.

7. Airplane Stress Analysis. T. R. Loudon.

Course 10, IV Year; 2 hrs. lectures per week, both terms.

An advanced course continuing the work of the Third Year on aircraft framed structures and stringer skin combinations. Shear flow in open and closed sections is discussed. Strain energy, the elastic centre and moment distribution methods are outlined. Simple and continuous beam columns are analyzed and various other structural problems encountered in aircraft design are taken up and problems worked out.

Text book: Analysis and Design of Airplane Structures—Bruhn.

8. Airplane Stress Analysis. T. R. Loudon.

Course 10, IV Year; 3 hrs. laboratory per week, both terms.

Problems are worked out using the theory explained in the lectures of subject 7. Some of this work is taken in conjunction with light aircraft design in laboratory work described in subject 6.

9. Airplan eStress Analysis. T. R. Loudon.

Course 10, III Year; 1 hr. lecture per week, both terms.

These lectures serve as an introductory course to the advanced structural analysis used in aircraft design in the fourth year.

Text books: Analysis and Design of Airplane Structures—Bruhn. Fundamentals of Aircraft Structures—Barton.

10. Airplane Stress Analysis Laboratory. T. R. Loudon.

Course 10, III Year; 3 hrs. laboratory per week, both terms.

Problems based upon the lectures in subject 9 are worked out during these periods.

11. Aircraft Propulsion.

Course 10, IV Year; 1 hr. lecture per week, both terms.

This course of lectures deals with theory of the propeller. The principles of operation of the reciprocating engine, turbo jet, gas turbine and rocket are explained.

12. Aircraft Layout. W. J. Jakimiuk, W. Jackson.

Course 10, III Year; 3 hrs. laboratory per week, second term.

Methods of layout and detailing peculiar to the aircraft industry.

APPLIED MECHANICS AND DESIGN OF STRUCTURES

20. Statics. T. R. Loudon.

Courses 1, 2, 3, 6, 7, 8, 8a, 9, and 11, I Year; 1 hr. lecture per week, first term; 2 hrs. lectures per week, second term.

Fundamental principles of the laws of equilibrium of forces are discussed. These principles are applied to the determination of stresses in simple structures.

Text book: Applied Statics—Loudon.

21. Dynamics. M. W. Huggins, B. Etkin.

Courses 1, 2, 3, 6, 7, 8, 8a, 9, and 11, I Year; 1 hr. lecture per week, first term; 2 hrs. lectures per week, second term.

A subject designed to extend the elementary principles of preparatory school mechanics to a more general viewpoint. Under the heading of kinematics, the general equations of motion, both linear and angular, are developed.

Centres of mass and moments of inertia are calculated.

The principles of linear and angular momentum are dealt with and a fairly comprehensive course on effective and inertia forces as applied to engineering problems is given. The discussion of energy, work, and power is extended as far as possible to practical problems.

Simple harmonic motion is also discussed.

Text book: Principles of Physics, Mechanics—Sears.

22. Dynamics. I. W. Smith, J. R. Doyle, F. C. Hooper, W. E. Morley.

Courses 1, 3, 7, and 11, II Year; 1 hr. lecture per week, both terms.

Motion of a point is reviewed and extended to include Coriolis' acceleration, with applications. Equations for motion of mass in translation, rotation, and plane motion are developed, including centre of percussion. Moment of inertia of mass is studied by double integration and by the lamina method. The derivation and application of gyroscopic action is thoroughly discussed, and an introduction to static and dynamic balancing is given.

Text book: Mechanics—Den Hartog.

23. Mechanics of Materials. T. R. Loudon, M. W. Huggins.

All courses, II Year; 2 hrs. lectures per week, both terms.

In this subject, the fundamental theories of stress and strain are discussed and applied in the design of tension members, riveted joints, pipes and tanks, beams, columns, shafts, etc. A number of problems are worked out both in the lecture course and in the drafting room.

Text book: Resistance of Materials—Seely.

24. Applied Mechanics. T. R. Loudon, B. Etkin.

Courses 5 and 10, I Year; 2 hrs. lectures per week, both terms.

This subject is divided into two parts: one dealing with the application of the principles of statics to elementary framed structures and simple beams, and the other dealing with the fundamental principles of dynamics of a particle extended eventually to consideration of rigid bodies.

Text books: Applied Statics—Loudon. Principles of Physics, Mechanics—Sears.

25. Dynamics. B. Etkin.

Courses 5 and 10, II Year; 1 hr. lecture per week, both terms.

Introduction to vectors; general plane motion of particles systems

of particles, and rigid bodies; compound pendulum, centre of percussion, gyroscopes.

Text books: Engineering Mechanics (vol. 2)—Timoshenko and Young. Principles of Mechanics—Synge and Griffiths.

26. Gas Dynamics. G. N. Patterson.

Course 10, IV Year; 2 hrs. lectures per week, both terms.

An advanced course in the aerodynamic theory of compressible fluids. The main topics are: one dimensional gas dynamics, shock waves, method of small perturbations, characteristics, hodograph method, application to subsonic and supersonic aerofoils, transonic problems, experimental methods.

27. Advanced Engineering Mechanics. B. Etkin.

Course 10, III Year; 1 hr. lecture per week, both terms.

Introduction to the operators curl, div. and grad. Plane and Space dynamics using the vector rotation. Euler's equation for a rigid body. Lagranges equations. Vibrations. Dimensional analysis and model testing.

Text books: Principles of Mechanics—Synge and Griffiths. Engineering Mechanics (vol. 2)—Timoshenko and Young.

28. Elementary Structural Engineering. C. F. Morrison.

Course 1, III Year; 2 hrs. lectures per week, both terms.

An elementary study of the stress analysis and design of structures, structural members, and their details. Problems in analysis and design are worked out in the lectures and in the drafting room.

The work in the first term includes a discussion of tension members, steel and timber columns, simple and continuous beams, box girders, and plate girders. Welding as a method of connecting structural steel members is studied.

The second term is given chiefly to moving loads, the design of a riveted truss highway span, and the theory of railway truss spans.

Text books: Theory of Simple Structures—Shedd and Vawter. Structural Problems—Young and Morrison. Steel Construction Handbook—A.I.S.C.

29. Elementary Structural Engineering. C. F. Morrison, M. W. Huggins.

Courses 2, 3, 8a, 10, and 11, III Year; 1 hr. lecture per week, both terms.

Practically the same work as that for subject 28 in the first term.

31. Mechanics of Materials: General. T. R. Loudon, W. L. Sagar, C. E. Helwig.

Courses 1, 2, 5, 9, and 10, II Year; 3 hrs. laboratory per week, second term.

Courses 3, 7, and 11, II Year; 3 hrs. laboratory per week, first term.

An introduction to the experimental study of the strength and elasticity of engineering materials. In it he should acquire a first hand knowledge of the properties of certain common materials of construction, and some familiarity with the manner in which they might be expected to behave when subjected to loads.

Reference book: Junior Laboratory Course in Mechanics of Materials, Department of Civil Engineering; Municipal and Structural.

33. Applied Elasticity. M. W. Huggins.

Courses 1 and 10, III Year; 1 hr. lecture per week, both terms.

A study of the stresses and strains in structural materials and members. The topics treated include: members subjected to direct stress, shear stress, and flexural stress, and their resulting deformations; principal stresses; statically indeterminate structures such as continuous and fixed-end beams; the moment-area theorems; photo-elasticity as a method of determining stress intensity.

Reference books: Elements of Strength of Materials—Timoshenko and MacCullough. Applied Elasticity—Timoshenko and Lessels.

34. Fluid Mechanics. B. Etkin.

Course 10, III Year; 1 hr. lecture per week, both terms.

Vector operators; classical equations for perfect fluids, velocity potential, stream function, complex potential. Vorticity, circulation, flow past cylinder with lift. Hydraulic machinery, torque converter. Simple cases of viscous flow.

Text books: Treatise on Hydromechanics—Ramsay. Airfoil and Airscrew Theory—Glauert. Fluid Mechanics—Hunsaker and Rightmire.

35. Cements and Concrete. W. L. Sagar, C. E. Helwig.

Courses 1 and 2, III year; 1 hr. lecture per week, both terms.

The work in the first term includes a discussion of the cements used in construction, Portland cement in particular, and a study of the basic principles of concrete making.

In the second term the elements of the theory of reinforced concrete are discussed and examples are considered in the design of slabs, beams, and columns.

Text books: Plain Concrete—Bauer. Chemistry of Cement and Concrete—Lea and Desch. Reinforced Concrete Design—Sutherland and Clifford. Reinforced Concrete Construction, Vol I—Hool Elementary Structural Engineering—Urquhart and O'Rourke

36. Theory of Structures. C. F. Morrison.

Course 1, IV Year; 2 hrs. lectures per week, both terms.

The stress analysis of simple span, continuous, and cantilever trusses. Influence lines and index stresses. Truss deflections by

analytical and graphical methods. Arches, suspension bridges, and statically indeterminate structures.

Text books: Theory of Simple Structures—Shedd and Vawter. Theory of Modern Steel Structures, Vol. II—Grinter.

38. Mechanics of Materials: General. T. R. Loudon, W. L. Sagar, C. E. Helwig.

Course 1, IV Year; 3 hrs. laboratory per week, both terms.

Practice in investigating the elastic and physical properties of iron, steel, concrete, timber, etc., and the use of instruments of precision designed for this purpose.

Reference book: Materials of Construction—Johnson.

39. Foundations and Retaining Walls. T. R. Loudon.

Course 1, IV Year; 1 hr. lecture per week, both terms.

A study of the necessity for accurate knowledge of sub-surface conditions as a preliminary to all foundation, retaining wall and dam design serves to introduce this course which deals with methods of sub-surface exploration, and the elements of the designs of foundation units, and retaining walls of concrete and of steel. Attention is paid to relevant constructional requirements.

40. Soil Mechanics. W. L. Sagar.

Course 1, IV Year; 1 hr. lecture per week, first term.

A subject devoted to those physical and mechanical properties of soils of importance to the engineer, such as compressive and cohesive strengths, internal friction, stability in slopes, compressibility and other deformational characteristics, permeability and moisture retention. The bearing of these properties on the design and construction of engineering works is considered in detail.

Reference books: Engineering Properties of Soil—Hogentogler. Notes on Soil Mechanics and Foundations—Plummer.

41. Reinforced Concrete. M. W. Huggins.

Course 1, IV Year; 1 hr. lecture per week, both terms.

The theory of the strength of reinforced concrete elements, including the beam, the slab, the T-beam, the column, and the girderless floor, is continued in this subject.

The analysis of the monolithic arch by the elastic theory is discussed, and the student is required in the drafting room to apply his knowledge to the design of simple structures.

Reference books: Design of Concrete Structures—Urquhart and O'Rourke. Reinforced Concrete Design—Sutherland and Reese.

43. Structural Design. M. W. Huggins.

Course 1, IV Year; 2 hrs. lectures per week, first term; 1 hr. lecture per week, second term.

Consideration is given to the various types of industrial buildings and other structures, the conditions governing their choice, and the design and details of construction in different materials. Examples

in design are worked out in the class and drafting rooms illustrating such points as: economic arrangement of building frames, probable loadings for girders and columns, column eccentricities, wind loading, wind bracing, rigid frames, crane runways, cableways, headframes, tanks and towers.

Reference books: Handbook of Building Construction—Hool and Johnson. Architects' and Builders' Handbook—Kidder-Parker. Steel Mill Buildings—Ketchum. Structural Problems—Young and Morrison.

44. Mechanics of Materials: Concrete. T. R. Loudon, W. L. Sagar, C. E. Helwig.

Course 1, III Year; 2 hrs. laboratory per week, first term.

Fundamentals in the design of sound concrete, including acceptability tests on the materials used in making concrete, experiments to show the effect on the consistency and strength of the concrete caused by variations in the quantities of the ingredients, and the design of an economical mix for a given set of conditions.

Reference books: Design and Control of Concrete Mixtures—Portland Cement Association. Materials Testing—Gilkey, Murphy, Bergman.

46. Structural Engineering. C. F. Morrison.

Courses 3 and 11, IV Year; 2 hrs. lectures per week, first term.

A study is made of various types of industrial buildings and other structures Methods of analysis and examples in design are considered, involving the use of timber, structural steel, and reinforced concrete.

Reference books: Elementary Structural Engineering—Urquhart and O'Rourke. Steel Mill Buildings—Ketchum. Handbook of building Construction—Hool and Johnson. Structural Problems—Young and Morrison.

50. Mechanics of Materials: Soils and Highway. W. L. Sagar, C. E. Helwig.

Course 1, IV Year; 3 hrs. laboratory per week, second term.

Experiments relating to the physical properties of rocks such as are used in road building, and bituminous materials as used in road and airport construction. Physical and mechanical characteristics of soils related to highway and foundation work, are investigated in a series of experiments that provide an introduction to practical Soil Mechanics.

Reference books: Construction of Roads and Pavements—Agg. Specifications—Dept. of Highways, Ontario. Soil Mechanics—Krynine.

APPLIED PHYSICS

70. Applied Physics. J. T. N. Atkinson.

Courses 7 and 11, II Year; 1 hr. lecture per week, both terms.

Correlating the physical principles of light, heat, sound, and vibration with problems in engineering, emphasizing the importance of the analytical approach.

Reference books: College Physics—Perkins. Introduction to Physical Optics—Robertson.

71. Applied Physics Laboratory. J. T. N. Atkinson.

Courses 7 and 11, II Year; 3 hrs. laboratory per week, both terms.

Supplementing subject 70.

72. Optics. J. T. N. Atkinson.

Course 6, III Year; 1 hr. lecture per week, both terms.

Light, geometrical and physical optics, and optical instruments pertaining to chemical engineering.

Text books: Optical Methods of Chemical Analysis—Gibb. Elements of Optics—Valasek.

73. Optics Laboratory. J. T. N. Atkinson.

Course 6, III Year; 3 hrs. laboratory per week, second term.

Supplementing subject 72.

75. Applied Physics. E. L. Dodington.

Course 1, II Year; 1 hr. lecture per week, both terms.

Correlating the physical principles of light, heat, sound and vibration with problems in engineering, emphasizing the importance of the analytical approach.

Reference book: Handbook of Engineering Fundamentals—Eshbach.

76. Applied Physics Laboratory. E. L. Dodington.

Course 1, II Year; 3 hrs. laboratory per week, both terms.

Supplementing subject 75.

77. Optics. J. T. N. Atkinson.

Courses 8 and 8a, II Year; 1 hr. lecture per week, both terms.

Simple harmonic motion, light geometrical and physical optics, and applications of optics in chemistry and metallurgy.

78. Optics Laboratory. J. T. N. Atkinson.

Courses 8 and 8a, III Year; 3 hrs. laboratory per week, both terms.

A laboratory course to supplement subject 77.

81. Photographic Surveying. K. B. Jackson.

Course 1, III Year; 1 hr. lecture per week, first term.

An introduction to the methods and applications of terrestrial and aerial photographic surveying.

82. Acoustics. V. L. Henderson.

Course 7, IV Year; 2 hrs. lectures per week, second term.

This subject deals with the properties of acoustical elements, particularly with their application in electrical sound systems.

Reference books: Elements of Acoustical Engineering—Olson. Applied Acoustics—Olson and Massa.

83. Acoustics Laboratory. V. L. Henderson.
Course 7, IV Year; 3 hrs. laboratory alternate weeks, second term.
Supplementing course 82.

89. Architectural Acoustics. V. L. Henderson.
Course 5i, IV Year; 2 hrs. lectures per week, both terms.
Design of buildings for good acoustics, the calculation and measurement of the acoustical properties of buildings and materials, and the treatment of buildings to improve their acoustical properties and to control the nuisance of noise.

90. Architectural Acoustics Laboratory. V. L. Henderson.
Course 5i, IV Year; 3 hrs laboratory per week, first term; 6 hrs. laboratory per week, second term.
Supplementing subject 89.

91. Illumination and Acoustics. V. L. Henderson.
Course 11, IV Year; 1 hr. lecture per week, both terms.
The production of light and the engineering principles underlying its utilization.
The generation and control of sound.

92. Illumination and Acoustics. V. L. Henderson.
Course 11, IV Year; 1½ hrs. laboratory per week, both terms.
A laboratory course supplementing course 91.

93. Illumination. E. L. Dodington.
Course 7, IV Year; 2 hrs. lecture per week, second term.
Illuminating Engineering dealing with the nature, measurement, and production of light and related radiations.
Theory of human vision; the design and application of lighting equipment for visual efficiency and comfort. Fundamentals of power supply.

94. Illumination Laboratory. E. L. Dodington.
Course 7, IV Year; 3 hrs. per week, second term.
Supplementing subject 93.

95. Photometry and Illumination Design. E. L. Dodington.
Course 5i, IV Year; 2 hrs. lectures per week, both terms.
Measurements of luminous intensity, luminous flux, illumination, brightness, reflection, transmission, absorption, diffusion, and colour by visual and physical methods; and on the design and application of illuminating engineering equipment.

96. Photometry and Illumination Design Laboratory. E. L. Dodington.
Course 5i, IV Year; 3 hrs. laboratory per week, first term; 6 hrs. laboratory per week, second term.
Supplementing subject 95.

97. Acoustics. V. L. Henderson.

Course 5e, IV Year; 2 hrs. lectures per week, first term.

Acoustics of electrical sound systems; including sound waves, hearing. the mechanical-electrical-acoustical analogy, microphones, loud speakers, etc.

Reference books: Elements of Acoustical Engineering—Olson. Applied Acoustics—Olson and Massa.

99. Vibration Engineering. V. L. Henderson.

Course 5t, IV Year; 1 hr. lecture per week, both terms.

Vibrating systems with one degree of freedom. Electrical analogues and impedance methods. Systems with more than one degree of freedom. Application to machines and structures. Instrumental methods.

100. Vibration Laboratory. V. L. Henderson.

Course 5t, IV Year; 3 hrs. laboratory per week, both terms.

A series of experiments designed to give familiarity with the nature of vibrating systems and the causes, measurement, and control of vibration in engineering problems.

ASSAYING, MINING AND ORE DRESSING

160. Assaying. M. Hewer.

Courses 2, 8, and 9, III Year; 1 hr. lecture per week, both terms.

Theory and practice of fire assaying. Emphasis is laid not only upon the principles of chemistry, metallurgy and sampling involved. but also upon the errors inherent in operators as well as in methods,

References: Manual of Fire Assaying—Fulton and Sharwood. Textbook of Fire Assaying—Bugbee. Fire Assaying—Shepherd and Dietrich. The Sampling and Assay of the Precious Metals—E. A. Smith.

161. Assaying Laboratory. M. Hewer.

Courses 2, 8, and 9, III Year; 3 hrs. laboratory per week, both terms.

The determination of precious metals. Scorification, crucible and combination wet and dry methods of assaying ores both simple and complex; milling and metallurgical products including cyanide solutions, cyanide precipitates and gold bullion. Special attention is given to the sampling and assay of ores containing metallics.

162. Assaying Laboratory. M. Hewer.

Course 8a, III Year; 3 hrs. laboratory per week, first six laboratory periods of first term; two lec tures periods of 2 hrs. each for the first two Mondays of the session.

An introductory laboratory subject for ceramic engineers. Some lecture instruction is given. An abbreviation of subjects 160 and 161.

165. Mining Laboratory. The Staff in Mining Engineering.

Courses 2 and 9, I Year; 2 hrs. per week, second term.

A combined laboratory and lecture course. It is an introduction to the principles of mining and sampling calculations. The rock drill, the handling of explosives, mine car loaders, and safety precautions, are also discussed.

166. Mining. R. E. Barrett.

Courses 2 and 9, II Year; 1 hr. lecture per week, first term.

A course of lectures relating to underground and surface mining methods, rock boring machinery and practice.

167. Mining. S. E. Wolfe.

Course 8, II Year; 1 hr. lecture per week, both terms.

The general principles of mining are considered with special attention to the association of mining and attendant metallurgical operations. The Ontario Mining Laws, The Ontario Workman's Compensation Act and safety regulations, as they pertain to mining, are discussed. Particular attention is given to the sampling of mineral deposits and the calculations of grades and tonnages. The course is designed to provide the metallurgist with a sufficient understanding of mining problems and practice to assure efficient cooperative effort in the Mineral Industry.

168. Mining. R. E. Barrett.

Courses 2 and 9, III Year; 1 hr. lecture per week, both terms.

Methods of mine development by mine adits, shafts, drifts and crosscuts; stoping methods, loading, and underground transportation.

169. Mining Laboratory. S. E. Wolfe.

Course 2, III Year; 3 hrs. laboratory per week, second term.

Special mining problems are given relating to sampling, diamond drilling, stope measurements, the factors affecting the angle of repose of broken materials and the behaviour of such materials when in motion. To develop the individual students' initiative, some special survey problems are worked in the laboratory.

170. Mining. R. E. Barrett.

Courses 2 and 9, IV Year; 2 hrs. lectures per week, second term.

Advanced studies of stoping methods, deep mining problems, mine mechanization, underground crushing, hoisting, and communications.

171. Mine Management. R. E. Barrett.

Courses 2 and 9, IV Year; 2 hrs. lectures per week, first term.

The discussion of certain aspects of business organization; option agreements, structure and financing of mining companies; mine plant and camp layouts; mine cost accounting and estimating; mine safety and hygiene; mine evaluation; labour relations—including a study of unions, collective bargaining agreements and associated problems.

172. Mining Laboratory. R. E. Barrett.

Courses 2 and 9, IV Year; 6 hrs. laboratory per week, second term.

Problems in mine planning involving shaft location and size; mine development; choice of stoping methods, mining rate, and mine equipment; time and cost schedules; ore reserve calculations.

175. Mine Ventilation and Allied Problems. G. R. Lord.

Course 2, IV Year; 2 hrs. lectures per week, first term.

Ventilation problems in Canadian mines, including the use of ventilation equipment, selection of fans, testing equipment, ventilation studies, the silicosis problem, fire control, etc.

176. Mine Ventilation Laboratory. The Staffs in Mining and Mechanical Engineering.

Course 2, IV Year; 3 hrs. laboratory per week, first term.

Experiments in the laboratories and problems in the study room to give the student some practice in the use of ventilation test equipment, and the solution of ventilation problems.

180. Principles of Mineral Dressing. S. E. Wolfe.

Courses 2, 8, and 9, III Year; Course 8a, IV Year; 2 hrs. lectures per week, first term.

This special course of lectures includes pertinent references to those fundamental laws of physics and chemistry, which apply to surfaces and affect surface tension, capillarity, the properties of colloidal solutions, pH, and the rate of filtration, etc. These are essential to the understanding of mineral dressing principles studied in the subsequent courses.

181. Ore Dressing. S. E. Wolfe.

Courses 2 and 8, III Year; 2 hrs. lectures per week, second term.

The general principles of ore dressing are discussed with particular attention to various beneficiating processes and their application in modern machines used for comminution, sizing, and gravity concentration.

182. Ore Dressing Laboratory. S. E. Wolfe.

Courses 2 and 8, III Year; 6 continuous hrs. laboratory work per week, second term.

This work is coordinated with lecture course 181 Studies are made of crushing machinery, the principles of crushing and grading rock products, screen analysis, and the sampling of broken material and mill products. Certain tests with gravity concentrating equipment are made

183. Ore Dressing. S. E. Wolfe.

Course 2 and 8, IV Year; 1 hr lecture per week, both terms.

The subjects covered are extensions of those in 181 and 182. Flowsheets, cyanidation, flotation processes and technique, the

current practice at milling plants, and special milling problems are discussed

184. Ore Dressing Laboratory. S. E. Wolfe.

Courses 2 and 8, IV Year; 6 continuous hours per week, first term.

Advanced work coordinated with lecture course 183 and pertaining to ore dressing appliances, the handling in bulk of finely divided solids, the selective flotation of sulphides, ore testing, and check mill runs.

185. Ore Dressing Laboratory. S. E. Wolfe.

Course 8a, IV Year; 3 hrs. laboratory per week, both terms.

The principles of sampling, crushing, grading, screen analysis, concentration with gravity equipment, flotation, ore testing, etc., with special reference to industrial rocks and minerals.

190. Theory of Measurements. S. E. Wolfe.

Courses 2 and 9, II Year; 1 hr. lecture per week, first term.

Engineering work requires the practical utilization of measurements which have varying degrees of precision. This course deals with the philosophy underlying the causes of errors, their effect and relative importance upon computed results, and the interpretation of numbers to represent measurements The use of charts and graphs to illustrate certain measurements and the derivation of empirical equations from these charts is also considered.

191. Summer Letters. R. E. Barrett.

Course 2, III Year.

A series of letters written during the summer vacation, dealing with various aspects of a mining engineer's work. These are intended to direct and help the student's powers of observation and analysis, as well as being exercises in the art of lucid technical expression.

Special instructions will be issued in connection with these letters.

192. Summer Essays. R. E. Barrett.

Course 2, IV Year.

An essay, or report, written on a mining subject, preferably some phase of work with which the student is associated during summer employment. Subsequently, each student will deliver a talk to his class on the subject chosen. Thus, training is afforded in both technical writing and public speaking. Students are briefed in advance concerning requirements of this course.

193. Problems and Seminar. The Staff in Mining Engineering.

Course 2, II, III, and IV Years; Course 9, II Year; 2 hrs. seminar per week, first term.

A seminar in which the students discuss technical and business problems, under their own supervision. A portion of the time is given to guest speakers on special subjects.

ASTRONOMY AND GEODESY

200. Practical Astronomy. G. T. Horton.

Course 1, II Year; 2 hrs. lectures per week, second term.

Practical determination of time, latitude, and azimuth, by methods adapted to the use of the surveyor's transit. The subject will be designed to enable the student to carry out these observations at the Summer Survey Camp.

Text books: Nautical Almanac, for current year. Practical Astronomy for Engineers—G. T. Horton.

201. Astronomy and Geodesy. J. W. Melson, O. J. Marshall.

Course 1, III Year; 2 hrs. lectures per week, second term.

Determination of time, latitude, longitude, and azimuth, by methods adapted to the use of the surveyor's transit and the sextant. It is designed to fulfil the requirements of the final examinations for Ontario and Dominion Land Surveyors.

In Geodesy an account is given of the principles and methods of a secondary triangulation survey, also of the principles involved in the North-west system of survey.

Text books: Practical Astronomy as applied to Geodesy and Navigation—Doolittle. Notes on Practical Astronomy and Geodesy. Nautical Almanac.

BOTANY

211. Low Temperature Physiology. G. H. Duff.

Course 5t, IV Year; 1 hr. lecture per week, both terms.

Cryophilic organisms and the physiological and biochemical effects of low temperature.

212. Low Temperature Physiology Laboratory. G. H. Duff.

Course 5t, IV Year; 3 hrs. laboratory per week, both terms.

A laboratory subject supplementing subject 211.

CIVIL ENGINEERING

214. Sanitary Engineering. A. E. Berry.

Course 1, IV Year; 1 hr. lecture per week, both terms.

Problems of water supply, sewerage, and municipal sanitation as viewed by the engineer. This subject includes the design of water distribution and sewer systems, as well as water and sewage treatment works.

215. Sanitary Engineering Laboratory. A. E. Berry, W. M. Walkinshaw.

Course 1, IV Year; 3 hrs. per week, both terms.

Problems on the design of water distribution and sewer systems as well as water and sewage treatment works.

216. Municipal Administration. A. E. Berry

Course 1, IV Year; 1 hr. lecture per week, second term.

Municipal government, assessment and taxation, municipal finance, public utilities, expropriation, annexation problems, town

planning, local improvement, and other laws relating to municipalities. Problems are assigned, from assumed data and from material secured in the field, to be worked out in the drafting room under subject 301.

217. Highway Engineering. W. L. Sagar.

Course 1, IV Year; 1 hr. lecture per week, both terms.

Principles governing the location, design, and construction of highways and airports.

218. Railway Engineering. W. M. Treadgold.

Course 1, IV Year; 1 hr. lecture per week, both terms.

Principles governing location, design and construction of railways.

CHEMISTRY AND CHEMICAL ENGINEERING

221. Chemistry. The Staff in Chemical Engineering.

Courses 1, 2, 3, 5, 6, 7, 8, 8a, 9, 10, and 11, I Year; 2 hrs. lectures per week, both terms.

Chemical theory, with industrial and engineering applications.

222. Chemical Laboratory. L. J. Rogers, W. F. Graydon.

Courses 1, 3, 5, 7, 10, and 11, I Year; 6 hrs. laboratory per week, one term.

Courses 2 and 9, I Year; 6 hrs. laboratory per week, both terms.

Course 6, I Year; 9 hrs. laboratory per week, one term; 6 hrs. laboratory per week, other term.

Courses 8 and 8a, I Year; 3 hrs. laboratory per week, both terms.

Quantitative experiments illustrating the use of the sensitive balance, and confirming the fundamental laws of chemistry; qualitative inorganic analysis; quantitative analysis.

223. Inorganic Chemistry. C. P. Brockett.

Courses 6, 8, and 8a, II Year; 1 hr. lecture per week, both terms.

A continuation of subject 221.

224. Chemistry. J. G. Breckenridge.

Courses 2 and 9, II Year; 1 hr. lecture per week, both terms.

A continuation of subject 221 including an introduction to organic chemistry

225 Analytical Chemistry. L. J. Rogers.

Courses 2, 8, and 9, III Year; 1 hr. lecture per week, both terms.

Principles of chemical analysis; select gravimetric and volumetric methods; technical analysis.

226 Engineering Chemistry. The Staff in Chemical Engineering.

Courses 1, 3, 7, and 11, II Year; 1 hr. lecture per week, both terms.

Water-softening, corrosion, petroleum, rubber, and plastics.

227. Analytical Chemistry Laboratory. E. A. Smith.

Courses 2 and 9, II Year; 3 hrs. laboratory per week, second term.

Gravimetric determination of metals and acids, with elementary volumetric analysis, accompanied by lectures.

228. Analytical Chemistry Laboratory. L. J. Rogers.

Courses 8 and 8a, II Year; 9 hrs. laboratory per week, both terms.

Comprising gravimetric and volumetric methods, acidimetry and alkalimetry.

Text books: Analytical Chemistry, Vol. II—Treadwell-Hall. Qualitative Chemical Analysis—A. A. Noyes.

229. Chemical Laboratory. L. J. Rogers, W. F. Graydon.

Course 6, II Year.

This subject will commence September 6, and will continue until September 24, 1949, the entire working week being spent in the laboratory on quantitative analysis.

230. Industrial Chemistry. E. A. Smith.

Courses 6 and 8a, II Year; 1 hr. lecture per week, first term; 2 hrs. lectures per week, second term.

Course 11, II Year; 1 hr. lecture per week, both terms.

Manufacture of acids, alkalies, and inorganic chemicals; water-softening, corrosion, explosives.

232. Industrial Chemistry and Technical Analysis. E. A. Smith, W. G. MacElhinney.

Course 6, II Year; 11 hrs. laboratory per week, first term.

An introductory laboratory subject in industrial chemistry containing experiments on petroleum products, fertilizers, etc., colorimetric determination of hydrogen-ion, stoichiometric calculations, instruction in glass-blowing.

234. Organic Chemistry. J. G. Breckenridge.

Course 6, II Year; 2 hrs. lectures per week, both terms.

An introductory course in organic chemistry, with emphasis on reaction conditions and yields, and the industrial significance of certain compounds and reactions.

235. Organic Chemical Laboratory. R. R. McLaughlin, J. G. Breckenridge.

Course 6, II Year; 10 hrs. laboratory per week, second term.

A laboratory subject accompanying lecture subject 234.

236. Physical Chemistry. D. J. LeRoy.

Courses 6, 8, and 8a, II Year; Course 9, III Year; 2 hrs. lectures per week, both terms.

Principles of Phase Rule; introduction to chemical thermodynamics and theory of solutions.

237. Analytical Chemistry Laboratory. L. J. Rogers.

Courses 2 and 9, III Year; 4 hrs. laboratory per week, first term; 3 hrs. per week, second term.

Technical analysis of ores and furnace products.

238. Industrial Chemistry and Chemical Engineering.

Industrial Chemistry. E. A. Smith, W. G. MacElhinney.

Course 6, III Year; 13½ hrs. laboratory per week, second term.

A continuation of subject 232, containing experimental work on coal, petroleum, illuminating gas, sugars, starch, etc. potentiometric determination of hydrogen-ion, and stoichiometric calculations.

Chemical Engineering. Staff in Chemical Engineering.
Course 6, III Year; 30 hrs. laboratory.
Experiments in Chemical Engineering introductory to subject 251.

239. Metallurgical Theory. W. C. Macdonald.
Course 8, III Year; 2 hrs. lectures per week, both terms.
A course for metallurgy students dealing particularly with Chemical Thermodynamics as applied to metallurgical reactions.

240. Chemical Theory. R. R. McLaughlin, W. C. Macdonald.
Courses 6 and 8a, III Year; 2 hrs. lectures per week, second term.
Chemical theory.

241. Industrial Chemistry. E. A. Smith.
Course 6, III Year; III Year Honour Chemistry (Arts); 1 hr. lecture per week, both terms.
Petroleum and its products, coal tar and its products, fats, oils, soap, sugar, starch, fermentation industries, etc.

242. Chemical Engineering. W. C. Macdonald, G. W. Minard.
Courses 6 and 8a, III Year; 2 hrs. lectures per week, first term.
The theory and practice of heat transfer, evaporation, filtration, and other industrial operations.
Text book: Elements of Chemical Engineering—Badger and McCabe.

244. Organic Chemistry. R. R. McLaughlin, J. G. Breckenridge.
Course 6, III Year; 2 hrs. lectures per week, both terms.
A continuation of subject 234.

245. Organic Chemical Laboratory. R. R. McLaughlin, J. G. Breckenridge.
Course 6, III; $10\frac{1}{2}$ hrs. laboratory per week, first term.
A laboratory subject accompanying lecture subject 244.

246. Electrochemistry. F. E. W. Wetmore.
Courses 6 and 8, III Year; 16 lectures, first term.
Elementary electrochemistry.

247. Electrochemistry Laboratory. F. E. W. Wetmore.
Course 6, III Year; 18 hrs., first term.
Course 8, III Year; 3 hrs. per week, first term.
Quantitative measurements to accompany subject 246.

248. Chemical Engineering Thermodynamics. W. C. Macdonald.
Course 6, IV Year; 1 hr. lecture per week, both terms.
Chemical thermodynamics, dealing with problems in chemical engineering.

249. Organic Chemistry. R. R. McLaughlin, J. G. Breckenridge.
Course 6, IV Year; 1 hr. lecture per week, both terms.
A continuation of subjects 234 and 244.

250. Organic Chemistry. J. G. Breckenridge.
Courses 5 and 8a, II Year; 1 hr. lecture per week, both terms.
General reactions and methods of synthesis of carbon compounds.
Text book: Chemistry of Organic Compounds—Conant.

251. Chemical Engineering and Organic Chemistry. Staff in Chemical Engineering.
Course 6, IV Year; 15 hrs. laboratory per week, first term.
This subject is a continuation of subjects 238 and 245, and includes experiments involving quantitative measurements on chemical engineering equipment, production of organic compounds using small-scale pilot-plant apparatus, and certain experiments in the fields of physical, analytical, and organic chemistry.

252. Chemical Engineering Problems. W. G. MacElhinney.
Course 6, IV Year; 2 hrs. laboratory per week, second term.
Calculations in connection with various problems in chemical engineering.

253. Chemical Engineering. G. W. Minard.
Course 6, IV Year; 1 hr. lecture per week, both terms.
A continuation of subject 242.

254. Graphical Methods in Chemical Engineering. G. W. Minard.
Course 6, IV Year; 1 hr. laboratory per week, both terms.
This subject gives the student instruction and practice in the use of elementary principles for constructing nomograms, and the derivation of empirical equations by graphical methods.

258. Industrial Chemistry. E. A. Smith.
Course 6, IV Year; 1 hr. lecture per week, first term.
IV Year Forestry; 1 hr. lecture per week, both terms.
Pulp and paper, and cellulose industries.

259. Chemical Theory. W. C. Macdonald.
Course 6, IV Year; 1 hr. lecture per week, first term; 2 hrs. lectures per week, second term.
A course on applied chemical kinetics and Phase Rule.

DESCRIPTIVE GEOMETRY, ENGINEERING PROBLEMS AND DRAWING

DESCRIPTIVE GEOMETRY

270. Descriptive Geometry. J. R. Cockburn, A. Wardell.
All Courses, I Year; 1 hr. lecture per week, both terms.
This subject deals chiefly with the principles of orthographic and oblique projections and the application of such principles to the solutions of problems relating to straight lines and planes.

272. Descriptive Geometry. J. R. Cockburn, A. Wardell.
Courses 1, 2, 3, 7, 9, 10, and 11, II Year; 1 hr. lecture per week, both terms.

A continuation of the work taken in the First Year, with the following additions: problems relating to curved surfaces, principles of shades, shadows and perspective.

274. Descriptive Geometry. J. R. Cockburn.

Course 1, III Year; 1 hr. lecture per week, first term.

Spherical projections, the principles of mapmaking, and the graphical solution of spherical triangles.

ENGINEERING PROBLEMS AND DRAWING

These subjects consist primarily in the solving of problems by the student at the drafting table under the personal guidance of an instructor. The problems are intended to supplement certain lecture courses. The problems in the First and Second Years deal with the fundamental engineering studies—Mathematics, Applied Mechanics, Descriptive Geometry, the plotting of surveys that have been made by the students in the field, Theory of Machines, while in the Third and Fourth Years, the problems deal mainly with design. During the hours devoted to mathematical problems, members of the staff in mathematics are present to assist.

275. Engineering Problems and Drawing. A Wardell.

Course 1, I Year; 14 hrs. per week, first term; 9 hrs. per week, second term.

Drawing and lettering. Plotting of original surveys. Problems in descriptive geometry. Graphical and analytical solutions of problems in applied mechanics. Problems in mathematics (analytical geometry and calculus).

276. Engineering Problems and Drawing. A. Wardell.

Courses 2 and 9, I Year; 6 hrs. per week, first term; 6 hrs. per week, second term.

Similar to subject 275.

277. Engineering Problems and Drawing. A. Wardell.

Courses 3 and 11, I Year; 8 hrs. per week, first term; 15 hrs. per week, second term.

Similar to subject 275.

279. Engineering Problems and Drawing. A. Wardell.

Course 5, I Year; 6 hrs. per week, first term; 3 hrs. per week, second term.

Course 10, I Year; 3 hrs. per week, first term; 6 hrs. per week, second term.

Drawing and lettering. Problems in descriptive geometry. Graphical and analytical solutions of problems in applied mechanics.

280. Engineering Problems and Drawing. A. Wardell.

Course 6, I Year; 4 hrs. per week, first term; 8 hrs. per week, second term.

Elementary drawing and lettering. The solving of a few problems in descriptive geometry, applied mechanics, and mathematics.

281. Engineering Problems and Drawing. A Wardell.

Course 7, I Year; 11 hrs. per week, first term; 6 hrs. per week, second term.

Similar to subject 275.

282. Engineering Problems and Drawing. A Wardell.

Courses 8 and 8a, I Year; 3 hrs. per week, first term; 6 hrs. per week, second term.

Similar to subject 275.

284. Engineering Problems and Drawing.

Course 1, II Year; 8 hrs. per week, both terms.

Problems in descriptive geometry—intersection of curved surfaces. Plotting of original surveys. Problems in mechanics of materials—properties of sections, designs of simple members. Problems in mathematics (calculus).

285. Engineering Problems and Drawing.

Courses 2 and 9, II Year; 8 hrs. per week, both terms.

Problems in descriptive geometry, mechanics of materials. Flow sheet. Plotting of original surveys.

286. Engineering Problems and Drawing.

Course 3, II Year; 8 hrs. per week, first term; 12 hrs. per week, second term.

Course 11, II Year; 6 hrs. per week, first term; 8 hrs. per week, second term.

Problems in descriptive geometry—intersection of curved surfaces. Problems in mechanics of materials, theory of machines. Problems in mathematics (calculus).

Course 10, II Year; 3 hrs. per week, both terms.

287. Engineering Problems and Drawing.

Course 6, II Year; 3 hrs. per week, first term; 6 hrs. per week, second term.

Problems in mechanics of materials and mathematics. Flow sheets.

288. Engineering Problems and Drawing.

Course 7, II Year; 6 hrs. per week, first term; 3 hrs. per week, second term.

Similar to subject 286.

289. Engineering Problems and Drawing.

Course 8, II Year; 3 hrs. per week, first term; 3 hrs. per week, second term.

Problems in mechanics of materials and mathematics.

290. Engineering Problems and Drawing.
Course 8a, II Year; 3 hrs. per week, first term; 6 hrs. per week, second term.
Similar to subject 287.

291. Engineering Problems and Drawing. W. B. Dunbar.
Course 1, III Year; 10 hrs. per week, first term; 9 hrs. per week, second term.
Problems in design of steel structures, riveted and welded connections, tension members, beams, columns, highway and railway trusses. Problems in descriptive geometry to illustrate the theory of map making.

292. Engineering Problems and Drawing. W. B. Dunbar.
Course 2, III Year; 3 hrs. per week, first term.
Problems in design of steel structures, riveted and welded connections, tension members, beams, columns.

293. Structural Design Drawing. W. B. Dunbar.
Course 3, III Year; 3 hrs. per week, both terms.
Similar to subject 292.

297. Engineering Problems and Drawing. W. B. Dunbar.
Course 8a, III Year; 3 hrs. per week, both terms.
Similar to subject 292.

298. Structural Design Drawing. W. B. Dunbar.
Course 11, III Year; 6 hrs. per week, first term; 3 hrs. per week, second term.
Similar to subject 292.

299. Engineering Problems and Drawing, Structural. W. B. Dunbar, P. V. Jermyn.
Course 1, IV Year; 6 hrs. per week, both terms.
Advanced problems on the design of steel and reinforced concrete structures—floor panels, mill buildings, truss and arch bridges, foundations, dams, retaining walls, wind bracing. Problems on moment distribution in rigid frames influence lines, and deflection of trusses.

300. Structural Design Drawing. W. B. Dunbar, P. V. Jermyn.
Courses 3 and 11, IV Year; 3 hrs. per week, first term.
Problems on the determination of stresses in, and the design of mill, building, flume trestles, crane runways, and floor panels for machinery loading.

BUSINESS ADMINISTRATION, ECONOMICS, HISTORY AND LAW

306. Accounting. S. G. Hennessey.
Course 11, III Year; 2 hrs. lectures and 1 hr. laboratory per week, both terms.

An introduction to the theory and practice of Accounting, the procedures followed in the preparation of financial statements, and the use of Accounting as a means of control.

307. Statistics. R. J. Sutherland.

Course 11, III Year; 2 hrs. lectures per week, both terms.

An introduction to statistical technique to include frequency distributions, correlation, curve fitting, sampling theory and an introduction to statistical quality control.

308. Applied Economics. A. B. Jack.

Course 11, III Year; 2 hrs. lectures and 1 hr. laboratory per week, both terms.

A study of modern monetary and banking theory and practice; industrial fluctuations; labour, with particular attention to problems of income distribution and labour organization.

309. Business Policy. A. W. Currie.

Course 11, IV Year; 3 hrs. lectures and 2 hrs. laboratory per week, both terms.

Financing a business enterprise with some attention to the investment program of an individual; internal administration; marketing and purchasing of industrial goods.

310. Business. R. R. Grant.

Courses 1, 2, 3, 6, 7, 8, 8a, and 9, III Year; 1 hr. lecture per week, second term.

Elements of business and the basic organization thereof with an introduction to the principles of control through accounting records. The preparation of simple financial statements and explanations of the purpose of the information shown therein. A brief description of the use of business papers such as invoices, bills of exchange, and others.

311. Economics. R. L. Elliott, S. Triantis, A. E. Carlsen.

All courses, II Year; 2 hrs. lectures per week, both terms.

An Introduction to the study of Economics with special reference to the problems of the Canadian economy.

Text book: An introduction to Political Economy—Bladen.

313. Engineering Economics.

Courses 1, 2, 3, 7, 8, 9, and 11, IV Year; 1 hr. lecture per week; second term.

Principles by which the economic practicability of a project is judged and the comparison of competing proposals is made. Consideration is given to first cost and annual cost, methods of estimating, capital charges and operating expenses, financing of engineering projects, valuation and appraisals. Special attention is given to depreciation and the methods of providing for it. Typical numerical problems are discussed and solved.

Text books: Engineering Economics—Fish. Financial Engineering—Goldman. Principles of Engineering Economy—Grant. Introduction to Engineering Economy—Woods and De Garmo.

314. Engineering Law. P. H. Mills.

Courses 1, 3, 6, 7, and 11, IV Year; 1 hr. lecture per week, first term.

Course 1c, IV Year; 1 hr. lecture per week, first term.

A subject designed to co-ordinate engineering practice and law. In the work that is common to all students taking the subject, attention is directed to the duties and liabilities of the engineer, workmen's compensation, patents and inventions, copyrights, trade marks, industrial designs, promotion of companies, organization of companies, arbitration, expert evidence, trade unions, combines, industrial disputes and professional engineering associations.

Students in the Municipal Engineering Option are given additional lectures dealing with railways, highways, boundaries and surveys, easements and drainage.

Text book: Engineering Law—Laidlaw and Young.

315. Contracts and Specifications. W. Storrie.

Course 1, IV Year; 1 hr. lecture per week, second term.

Fundamental principles of contract and specification writing. The critical examination of typical specifications and agreements by the class, forms an essential feature of the instruction.

Text book: Engineering Law—Laidlaw and Young.

317. Plant Management. R. E. Barrett.

Course 8, IV Year, 1 hr. lecture per week, second term.

Twelve lectures dealing with some phases of management, including labour relations, plant organization, maintenance and safety.

318. Industrial Management. E. A. Allcut.

Courses 1, 3, 6, 7, and 8a, IV Year; 1 hr. lecture per week, both terms.

A study of industrial organization, location, arrangement, construction, and equipment of industrial plants for efficiency and economy, process routing, scheduling work, reports, methods of superintending, employment, systems of compensating labour, and systems of distributing indirect expenses.

Text book: Principles of Industrial Management—Allcut.

319. Public Speaking. The Staff in Chemical Engineering.

Course 6, IV Year; 1 hr. lecture per week, both terms.

320. Public Speaking. G. A. McMullen.

Course 11, II Year; 1 hr. lecture per week, second term.

Principles of public speaking and the means of expression, accompanied by practical application and training in actual speaking.

321. Industrial Management A.

Course 11, III Year; 1 hr. lecture and 2 hrs. laboratory per week, first term; 2 hrs. lectures and 1 hr. laboratory per week, second term.

An introduction to industrial organization and management, dealing particularly with its more technical aspects. Such problems as plant location, layout, arrangement, construction, handling of materials, inspection, design, and report writing are dealt with.

Text book: Principles of Industrial Management—Allcut.

322. Engineering and Society. H. L. Shepherd, G. R. Elliott.

All courses, I Year; 1 hr. lecture per week, both terms.

A series of lectures on economic history intended to show the dynamic role of science and technology in the development of the modern world, and the slow adaptation of social institutions under the impact of rapid technological change. Some attention will be given to the evolution of the more important branches of engineering and the origin of important existing practices and procedures.

323. Introduction to Political Science. R. MacG. Dawson, J. M. Beck.

All courses, III Year; 1 hr. lecture per week, both terms.

An introduction to the study of government with special reference to the problems of Canadian government.

324. Modern World History. J. M. S. Careless, G. M. Craig.

All courses, III Year; 1 hr. lecture per week, both terms.

An outline of the chief trends and developments since the beginning of the 19th Century, with emphasis on World History and the main aspects of international relations.

325. Modern Political and Economic Trends. E. Schonning.

All courses, IV Year; 1 hr. lecture per week, both terms.

A study of the theory and peactice of modern economic and political trends.

326. Philosophy of Science. Marcus Long.

Courses 1, 2, 3, 5, 6, 7, 8, 8a, 9, 10, and 11, IV Year; 18 lectures, first term, and part of second term.

The relation between Science and Philosophy; an examination of the presuppositions of science and its basic concepts; of the nature of the universe with its implications for social and moral behaviour.

327. The Profession of Engineering. C. R. Young.

Courses 1, 2, 3, 5, 6, 7, 8, 8a, 9, 10, and 11, IV Year; 6 lectures, second term.

Professional engineering organizations in Canada; engineering societies and services; professional ethics; social implications of engineering.

328. Industrial Management B.

Course 11, IV Year; 2 hr. lecture and 3 hrs. laboratory per week, both terms.

A continuation of subject 321, dealing with such matters as production, planning, time and motion study, costs, budgetary control, and payment of labour. Particular emphasis is placed upon the study of Industrial Relations.

329. Industrial Psychology. W. Line.

Course 11, IV Year; 2 hrs. lectures per week, both terms.

The Worker as a person. His nature and needs; achievement and satisfaction; ability, motivation, interest; adjustment and development. Individual differences. Learning at the level of skills and knowledge, and in a social sense. Morale, loyalty and responsibility.

Administrative provisions. The principles applied to administrative problems, e.g. conditions of work, diagnosis of difficulties, constructive policies; supply of personnel, selection, training and supervision.

Special Services. The role of professional services, e.g. health, social welfare, psychological service, etc.: their relation to the executive and to the community.

ELECTRICAL ENGINEERING

330. Electricity. Staff in Electrical Engineering

Courses 1, 2, 3, 5, 6, 7, 8, 8a, 9, 10, and 11, I Year; 2 hrs. lectures per week, both terms

Principles relating to electric circuits, magnetic circuits, instruments, and apparatus in general, with illustrations from commercial practice The point of view is quantitative rather than descriptive

Reference books: Introduction to Electrical Engineering—Mueller Electrical Engineering—Christie.

331. Alternating Currents. E. Wall, A. G. Ratz.

Courses 1, 2, 8, and 9, II Year; 1 hr. lecture per week, both terms.

Fundamental calculations of alternating current circuits and various applications of interest to those who are not making electricity a major subject.

332. Electricity. Staff in Electrical Engineering.

Courses 3, 6, 8, 8a, and 11, II Year; 2 hrs. lectures per week, first term.

Course 7, II Year; 2 hrs. lectures per week, second term.

General principles and calculations of electrical circuits, particularly as applied to the measurement of resistance, current, potential difference, inductance, capacity, power, and energy. The principles underlying commercial instruments are considered, together with the methods of calibration.

Reference books: Electrical Measurements—Laws. Electrical Measurements in Theory and Application—Smith. Electrical Measurements and Measuring Instruments—Golding.

333. Electrical Fundamentals. E. Wall, H. F. Philp.

Course 7, II Year; 2 hrs. lectures per week, both terms.

A series of lectures extending the study of the fundamental principles underlying the work of subject 332. Applications considered are of particular interest to electrical engineers.

334. Electrical Laboratory. H. A. Courtice.

Courses 3, 6, 8, 8a, and 11, II Year; 3 hrs. laboratory per week, first term.

Course 7, II Year; 6 hrs. laboratory per week, second term.

The more important methods of measurement of resistance, current, potential difference, inductance, and capacity are used, often under conditions such as occur in practice. The principles of measurement are applied to other problems such as the location of line faults and the measurement of temperature rise by resistance changes. Methods of calibrating commercial instruments are also included.

335. Electrical Problems and Seminar.

Course 7, III Year; 2 hrs. per week, both terms.

336. Mathematical Applications in Electrical Engineering. V. G. Smith, L. S. Lauchland, D. N. Cass-Beggs.

Course 7, III Year; 3 hrs. lectures per week, second term.

These lectures are intended to co-ordinate certain branches of mathematics, such as complex numbers, simple determinants, and elementary differential equations, with their applications to the problems of electrical engineering.

337. Electronics. J. E. Reid, G. Sinclair, R. Scott.

Course 7, III Year; Course 5t, IV Year; 3 hrs. lectures per week, second term.

The behaviour of electrons in electric and magnetic fields and the application of electronics to electrical engineering.

Reference book: Applied Electronics—M.I.T. Staff.

338. Direct Current Machines. The Staff in Electrical Engineering.

Courses 3 and 11, II Year; 2 hrs. lectures per week, second term.

Courses 3 and 11, II Year; 3 hrs. laboratory per week, second term.

A course on the theory and operation of direct current generators and motors.

Reference books: Electrical Engineering, I Vol.—Dawes. Electrical Circuits and Machinery, Vol 1—Morecroft and Hehre. Elements of Electrical Engineering—Cook.

339. Direct Current Machines. G. F. Tracy, D. N. Cass-Beggs, L. S. Lauchland.

Course 7, III Year; 2 hrs. lectures per week, first term.

The theory and operation of direct current machines. Methods of calculating the operating characteristics of generators and motors are presented and illustrated by the use of problems.

Reference books: Electrical Engineering, Vol. I—Dawes. Electrical Circuits and Machinery, Vol I—Morecroft and Hehre. Principles of D.C. Machines—Langsdorf. Direct Current Machinery—Pender. Electrical Engineering—Christie. Elements of Electrical Engineering—Cook. D.C. Machinery—Kloeffler, Brenneman and Kerchner. Direct Current Machinery—McFarland. Direct Current Machinery—Bull.

340. Alternating Currents. G. F. Tracy and staff.

Courses 3 and 11, III Year; 2 hrs. lectures per week, first term.

Courses 6 and 8a, III Year; 2 hrs. lectures per week, first term.

Measurements in simple single-phase and polyphase circuits. Circuit problems are solved by analytical and graphical methods. The operation of induction and synchronous motors and transformers is discussed briefly.

Reference books: Electrical Engineering, Vol. II—Dawes. Electrical Circuits and Machinery, Vol. II—Morecroft and Hehre. Elements of Electrical Engineering—Cook.

341. Alternating Currents. A. R. Zimmer, J. E. Reid.

Course 7, III Year; 2 hrs. lectures per week, both terms.

Course 5, III Year; 3 hrs. lectures per week, first term. (1949-50 only.)

A first course of lectures on alternating current, covering principles of measurement and leading to the analytical and graphical treatment of the simpler problems relative to alternating-current circuits and machinery.

Reference books: Electricity and Magnetism for Engineers, Part II—Pender. Electrical Engineering—Christie. Electrical Engineering, Vol. II—Dawes. Electrical Circuits and Machinery, Vol. II—Morecroft and Hehre. Alternating Current Circuits—Kerchner and Corcoran. Alternating Current Circuits—Bryant, Correll and Johnson. Alternating Current Electrical Engineering—Maccall. Alternating Current Electrical Engineering—Kemp. Elements of Electrical Engineering—Cook.

342. Electrical Design. L. S. Lauchland.

Course 7, III Year; 2 hrs. lectures per week, first term.

Derivation and application of formulae used in the design of magnets, direct current machines, transformers, and other electrical equipment.

343. Electrical Design Laboratory. L. S. Lauchland.
Course 7, III Year; 4 hrs. laboratory per week, first term.
To accompany subject 342.

344. Electrical Laboratory. A. R. Zimmer.
Course 7, III Year, 6 hrs. laboratory per week, first term; 3 hrs. laboratory per week, second term.
A group of experiments on direct current machines, another group on the fundamentals of alternating current circuits, together with experiments on properties of magnetic materials, and on the fundamentals of electronic devices. Introductory experience in the use of alternating current machinery is afforded.

345. Alternating Current Machinery. G. F. Tracy and staff.
Course 3, III Year; Course 11, IV Year; 2 hrs. lectures per week, second term.
Characteristics of alternating current machines and the various methods of control.

346. Electrical Laboratory. A. R. Zimmer.
Course 3, III Year; 3 hrs. laboratory per week, both terms.
Course 11, III Year; 3 hrs. laboratory per week, first term.
Course 11, IV Year; 3 hrs. laboratory per week, second term.
Experiments on alternating current circuits and machines.

348. Electrical Machinery. D. E. McGregor.
Courses 2 and 8, III Year; 2 hrs. lectures per week, first term.
Lectures and demonstrations dealing with the operation and characteristics of electrical machinery.

349. Electrical Laboratory. A. R. Zimmer.
Courses 6 and 8a, III Year; 3 hrs. laboratory per week, first term.
Experiments on direct current generators and motors, and alternating current circuits and machines.

350. Electrical Laboratory. A. R. Zimmer.
Courses 1, 2, 8, and 9, II Year; 3 hrs. laboratory per week, second term.
Experiments planned to give a general knowledge of the operation of direct current machines, simple alternating current circuits, and alternating current machines.

351. Circuit Analysis. V. G. Smith.
Course 7, IV Year; 2 hrs. lectures per week, first term; 3 hrs. lectures per week, second term.
Course 5e, IV Year; 2 hrs. lectures per week, both terms.
Applications of advanced analytical methods made to a.c. bridges, electrical filters, and other networks. Several general network theorems are obtained. The method of symmetrical components is developed and used to solve problems involving unbalance in

three-phase circuits. Complex wave forms of voltage and current and their analysis are considered in detail. Simple transients in a.c. circuits are also studied.

Reference books: Principles of Alternating Currents—Lawrence Alternating Current Circuits—Weinbach. Alternating Current Bridge Methods—Hague. Symmetrical Components—Wagner and Evans. Alternating Current Circuits—Kerchner and Corcoran.

352. Transmission at Low and High Frequencies. J. E. Reid, G. Sinclair, L. S. Lauchland.

Course 7, IV Year; 2 hrs. lectures per week, both terms.

Course 5e, IV Year; 2 hrs. lectures per week, first term.

The behaviour of a long line when the voltages and currents are sinusoidal is examined in detail. Graphical constructions are developed and applied to both short and long lines. Circuits with lumped and distributed constant are anlyzed over wide ranges of frequency and impedance. The distributed inductance and capacity of a three-phase transmission line are found.

353. Alternating Current Machinery I. D. N. Cass-Beggs, G. F. Tracy.

Courses 5t and 7, IV Year; 3 hrs. lectures per week, first term, 1 hr. lecture per week, second term.

The theory and performance of transformers, generators, synchronous motors, single and polyphase induction motors.

Reference books: Theory of Alternating Current Machinery—Langsdorf. Principles of Alternating Current Machinery—Lawrence. Alternating Current Machines—Puchstein and Lloyd. Alternating Current Machinery—Bryant and Johnson. Electrical Engineering—Christie.

354. Electric Circuits. G. F. Tracy and Staff.

Course 5, II Year; 2 hrs. lectures per week, both terms.

Principles of direct-current circuits including the more important methods of measuring resistance, potential difference, current, power and energy. Principles of alternating-current circuits together with methods of calculating single-phase and polyphase circuits, network theorems.

355. Electrical Laboratory. D. N. Cass-Beggs.

Course 7, IV Year; 4½ hrs. laboratory per week, first term; 1½ hrs. laboratory per week, second term.

Studies of principles and properties of single-phase and polyphase circuits and apparatus. Vector and analytical methods are applied to the solution of problems related to the characteristics of transformers, alternators, synchronous motors, converters, induction motors, transmission lines, and other alternating current equipment. The principles and properties of electronic equipment used in low frequency and power fields, such as mercury arc rectifiers and thyratrons, are studied.

Reference books: Electrical Engineering—Christie. Experimental Electrical Engineering, Vols. I and II—Karapetoff. Principles of A.C. Machinery—Lawrence. A.C. Machinery—Bryant and Johnson. Principles of Alternating Current Machinery—Langsdorf.

356. Electric Circuits Laboratory. Staff in Electrical Engineering.
Course 5, II Year, 3 hrs. laboratory alternate weeks, both terms.
Laboratory exercises to accompany subject 354.

357. Engineering Electronics. D. N. Cass-Beggs.
Courses 5e and 7, IV Year; 2 hrs. lectures per week, first term 1 hr. lectures per week, second term.
Electronic devices, such as the thyratron, ignition and mercury arc rectifier, and their application to engineering problems.
Reference books: Electron Tubes in Industry—Henney. Fundamental Electronics and Vacuum Tubes—Albert. Fundamentals of Engineering Electronics—Dow. Applied Electronics—E. E. Staff, M.I.T.

358. Engineering Electronics Laboratory. D. N. Cass-Beggs.
Courses 5e and 7, IV Year; 3 hrs. laboratory alternate weeks, both terms.
Laboratory experiments to accompany subject 357.

359. Electrical Problems and Seminar.
Course 7, IV Year; 2 hrs. per week, both terms.

360. Communications I. J. E. Reid, G. Sinclair.
Courses 5e, 5i, 5s, and 7, IV Year; 3 hrs. lectures per week, first term.
The basic principles of amplification, detection, modulation, demodulation, and radio-frequency power generation.
Reference books: Applied Electronics—M.I.T. Staff.

361. Communications Laboratory. G. Sinclair.
Courses 5e, 5i, 5s, and 7, IV Year; 3 yrs. laboratory per week, first term.
Experiments and problems to accompany subject 360.

362. Communications II. J. E. Reid, G. Sinclair.
Courses 5e and 7, IV Year; 3 hrs. lectures per week, second term.
A continuation of subject 360.

363. Communications Laboratory. G. Sinclair.
Courses 5e and 7, IV Year; 3 hrs. laboratory per week, second term.
Experiments and problems to accompany subject 362.

364. Operational Methods V. G. Smith.
Courses 5e, 5i, and 5s, IV Year; 2 hrs. lectures per week, both terms
A few examples of earlier operational methods are given. The operators of electric circuits are developed and solutions obtained, in the course of which several useful rules concerning shifting and

transfer operations, and differentiation and integration with respect to parameters are found and applied. The Heaviside expansion theorem is developed in a simple manner. The connection between Heaviside's methods and the classical methods of Fourier Integrals and Contour Integration is investigated in some detail Application is made throughout to engineering problems, chiefly in the field of electric circuit analysis.

Reference books: Electromagnetic Theory—Heaviside. Operational Circuit Analysis—Bush. Electric Circuit Theory and the Operational Calculus—Carson. Heaviside's Operational Calculus —Berg. Fourier Integrals for Practical Applications—Campbell and Foster.

365. Applied Electromagnetic Theory. V. G. Smith.

Courses 5e, 5g, and 5s, IV Year; 2 hrs. lectures per week, both terms.

The laws of electromagnetism are reviewed and Maxwell's field equations developed. Plane electromagnetic waves and their reflection and refraction at plane surfaces are studied. Skin effects in cylindrical conductors, both solid and hollow are considered. Transmission of energy by wave guides and co-axial cables is investigated. The laws and formulae of the radiation of energy from vertical antennae are developed. The capacity of cables and transmission lines is computed and comparison made between the exact and approximate formulae. Magnetic fields due to conductors carrying current in the neighbourhood of ferromagnetic bodies are investigated in some of the more simple cases

Reference books: Electromagnetic Theory—Heaviside. Electromagnetic Theory—Stratton. Electromagnetic Problems in Electrical Engineering—Hague.

366. Electronics. J. E. Reid.

Course 5, III Year; 2 hrs lectures per week, both terms.

Basic theory of the behaviour of electrons in electric and magnetic fields, thermionic emission, vacuum-tube characteristics and applications, conduction through gases, gaseous-tube characteristics and applications.

Reference book: Applied Electronics—M.I.T. Staff.

367. A.C. Machinery Laboratory. D. N. Cass-Beggs

Course 5t, IV Year; 3 hrs. laboratory per week, first term

A short laboratory course in alternating current electrical machinery

368. Electronics Laboratory. D. N. Cass-Beggs.

Course 5t, IV Year; 3 hrs. laboratory per week, second term.

A short laboratory course in electronics, vacuum tubes, and engineering electronics.

369. Alternating Current Machinery II. G. F. Tracy.
Course 7, IV Year; 2 hrs. lectures per week, second term.
A continuation of subject 353. Special types of alternating current motors, synchronous converters, single-phase induction motors.

370. Alternating Current Machinery Laboratory. G. F. Tracy, D. N. Cass-Beggs.
Course 7, IV Year; 3 hrs. laboratory alternate weeks, second term.
Laboratory exercises to accompany subject 369.

371. Ultra-High Frequency Communications. G. Sinclair.
Courses 5e and 7, IV Year; 2 hrs. lectures per week, second term.
Generation of microwaves. Magnetrons, velocity-variation tubes, resonatrons, etc. Wideband amplifiers and amplification of pulses. High-frequency measurements.

372. Ultra-High Frequency Laboratory. G. Sinclair.
Courses 5e and 7, IV Year; 3 hrs. laboratory alternate weeks, second term.
Laboratory exercises and problems to accompany subject 371.

373. Electrical Design. L. S. Lauchland.
Course 7, IV Year; 2 hrs. lectures per week, second term. A continuation of subject 342.

374. Electrical Design Laboratory. L. S. Lauchland.
Course 7, IV Year; 2 hrs. laboratory per week, second term.
Design projects and exercises to accompany subject 373.

375. Electrical Engineering. G. F. Tracy and Staff.
Course 10, III Year; 2 hrs. lectures per week, both terms.
Principles of d-c and a-c circuits including the more important methods of measuring resistance, current, potential difference, power and energy; the principles of operation of d-c and a-c machinery; thermionic tube characteristics and applications.

376. Electrical Engineering Laboratory. Staff in Electrical Engineering.
Course 10, III Year; 3 hrs. laboratory per week, both terms.
Laboratory exercises to accompany subject 375.

377. Electric Machines, G. F. Tracy and staff.
Courses 5e, 5s, and 5i, III Year; 2 hrs. lectures per week, both terms.
Operating characteristics, control, and applications of direct-current and alternating-current machines.

378. Electric Machines Laboratory. Staff in Electrical Engineering.
Courses 5e, 5s, and 5i, III Year; 3 hrs. laboratory per week, both terms. Laboratory exercises to accompany subject 377.

379. Electronics Laboratory. Staff in Electrical Engineering.
Course 5, III Year; 3 hrs. laboratory per week, second term.
Laboratory exercises to accompany subject 366.

GEOLOGICAL SCIENCES

GEOLOGY

380. Geological Field Work. G. B. Langford, W. W. Moorehouse.

Courses 2 and 9, III Year; one week at the University Survey Camp preceding the opening of the first term.

381. Geology, Pleistocene and Physiographic. A. MacLean.

Courses 2 and 9, IV Year; 1 hr. lecture per week, both terms.

Pleistocene Geology. The formation and distribution of the drift deposits of North America, with brief references to other regions.

Physiography. The surface forms of the earth, and the geological factors that have produced them.

Reference books: Ice Ages, Recent and Ancient, and The Last Million Years—Coleman. Physiography—Salisbury.

382. Geological Excursions. A. MacLean.

Courses 2 and 9, IV Year.

During October weekly trips will be made to points of interest near Toronto.

383. Historical Geology. L. S. Russell.

Course 9, III Year; 2 hrs. lectures per week, both terms.

Principles of sedimentation, divisions of the geological column and the use of fossils in correlation of formations.

Textbook: Historical Geology—Schuchert and Dunbar.

384. Historical Geology Laboratory. L. S. Russell.

Course 9, III Year; 2 hrs. laboratory per week, both terms.

Study of fossils, sediments, and geological maps and sections. A laboratory course to accompany subject 383.

385. Engineering Geology. A. MacLean.

Course 1, III Year; 1 hr. lecture per week, first term; 2 hrs. lectures per week, second term.

Structural, dynamic and economic geology, with special reference to engineering problems.

Reference books: Engineering Geology—Ries and Watson. Geology and Engineering—Legget.

386. Engineering Geology Laboratory. G. B. Langford.

Course 1, III Year; 2 hrs. laboratory per week, second term.

Specimens, maps, and sections to accompany subject 385.

388. General Geology. F. G. Smith.

Courses 2 and 9, I Year; Course 5g, III Year; 3 hrs. lectures per week, second term.

Geological principles, designed to introduce the student to the study of geology.

Reference books: Geology—Emmons, Thiel, Stauffer, and Allison. Elementary Geology for Canada—Moore.

390. Structural Geology. G. B. Langford.

Courses 2 and 9, III Year; Course 5g, IV Year; 1 hr. lecture per week, both terms.

Structures caused by the deformation of the earth's crust.

Text books: Geologic Structures—Willis. Structural Geology—Nevin.

391. Structural Geology. G. B. Langford.

Courses 2 and 9, III Year; Course 5g, IV Year; 3 hrs. laboratory per week, both terms.

Work with geological maps of folded and faulted areas, structure sections, and the solution of problems relating to folding and faulting. Laboratory course to accompany subject 390.

392. Precambrian Geology. E. S. Moore.

Courses 2 and 9, IV Year; 2 hrs. lectures per week, first term.

Precambrian formations of Canada—their rocks, distribution, relationships, and economic features. Briefer accounts are given of similar formations in the United States and elsewhere.

Reference books: Publications of the Dominion and Provincial geological surveys. Mineral Deposits of the Canadian Shield—Bruce.

393. Mining Geology. G. B. Langford.

Course 9, IV Year; 2 hrs. lectures per week, first term; 1 hr. lecture per week, second term.

Detailed study of the geology of Canadian and foreign mining camps.

394. Mining Geology. G. B. Langford.

Course 9, IV Year; 3 hrs. laboratory per week, both terms.

A laboratory course to accompany subject 393.

396. Mining Geology. E. S. Moore.

Course 2, IV Year; 2 hrs. lectures per week, second term.

Geological problems associated with mining, typical mining regions in Canada, the United States, and elsewhere discussed from the geological side.

Reference books: Gold Fields of the World—Emmons. Economic Mineral Deposits—Bateman.

397. Precambrian and Economic Geology Laboratory. W. W. Moorhouse.

Course 9, III Year; 2 hrs. laboratory per week, second term.

Special attention to Precambrian formations and the microscopic features of the rocks and mineral deposits.

398. Economic Geology. E. S. Moore.

Course 9, III Year; Course 5g, IV Year.

(*a*) Ore Deposits: 2 hrs. lectures per week, first term.

Discussion of the origin and classification of ore deposits, the mode of occurrence of the chief ores, and statistics of production. Special attention is given to the metals mined in Canada.

(*b*) Economic Geology of the non-metals: 2 hrs. lectures per week, second term.

The origin and mode of occurrence of the valuable non-metallic substances—coal, oil, building stone, gypsum, cement materials, etc.

Reference books: Economic Geology—Ries. Coal—Moore. Geology of Petroleum and Natural Gas—Lilley. Mineral Resources of Canada—Moore. Introduction to the Study of Ore Deposits—Hatch.

399. Economic Geology. E. S. Moore, F. G. Smith.

Course 2, III Year.

(*a*) Ore Deposits: 2 hrs. lectures per week, first term.

(*b*) Economic Geology of the non-metals: 1 hr. lecture per week, second term.

Similar to subject 398.

400. Economic Geology Laboratory. G. B. Langford.

Course 9, III Year; 3 hrs. laboratory per week, both terms.

Ores, geological features of mining areas, interpretation of drill logs, geological maps, and structure sections. Excursions are included.

401. Location of Mineral Deposits. G. B. Langford.

Course 5g, IV Year; 1 hr. lecture per week, both terms.

Geological features and principles involved in the application of geophysical methods in the search for mineral deposits, and the interpretation of the structure of the earth's crust.

402. Economic Geology. G. B. Langford.

Course 8a, IV Year; 2 hrs. lectures per week, second term.

The nature, occurrence, and origin of non-metallic deposits, excepting fuels.

Reference book: Industrial Minerals and Rocks—A.I.M.E.

403. Geology of Canada. A. MacLean.

Course 9, IV Year; 2 hrs. lectures per week, first term; 1 hr. lecture per week, second term.

A survey of the physiography, historical geology, major structural features, and mineral deposits of the country.

404. Geology of Canada. A. MacLean.

Course 9, IV Year; 2 hrs. laboratory per week, second term.

Accompanying subject 403.

406. Petroleum and Ground Water Geology. W. M. Tovell.

Course 9, IV Year; 1 hr. lecture per week, first term; 2 hrs. lectures per week, second term.

The origin, nature, and occurrence of petroleum and natural gas deposits and the extraction of these substances from the earth. The circulation of ground water, and the geological conditions controlling the formation of water supplies.

407. Petroleum and Ground Water Geology Laboratory. W. M. Tovell.

Course 9, IV Year; 3 hrs. laboratory per week, first term.

Accompanying subject 406.

HEAT ENGINES

420. Elementary Heat Engines. E. A. Allcut, F. G. Ewens, J. R. Doyle, O. Clodman, E. J. Durand.

Course 3, II Year; 1 hr. lecture per week, both terms.

Course 11, II Year; 1 hr. lecture per week, both terms.

Courses 2, 8, and 9, II Year; 1 hr. lecture per week, first term.

Course 7, II Year; 1 hr. lecture per week, first term.

Course 10, II Year; 1 hr. lecture per week, first term.

The history and development of heat engines generally, the principles upon which they operate, and brief descriptions of the mechanical and thermal features of the different kinds of heat engines used in practice.

Text book: An Introduction to Heat Engines—Allcut.

421. Theory of Heat Engines. E. A. Allcut, P. B. Hughes, F. C. Hooper, J. R. Doyle.

Course 3, III Year; 2 hrs. lectures per week, both terms.

Courses 5t and 10, III Year; 2 hrs. lectures per week, both terms.

Courses 6 and 8a, III Year; 2 hrs. lectures per week, both terms.

Course 7, III Year; 2 hrs. lectures per week, both terms.

Course 11, III Year; 2 hrs. lectures per week, both terms.

For each group selected topics are arranged to suit the courses included in the group.

The application of the laws of thermodynamics to ideal processes and cycles using gases and vapours. The cycles used in practice for steam and internal combustion engines, compressors and refrigerating plants. Unavailable energy and entropy. Theoretical and practical efficiencies obtainable. Heat transfer and regeneration. Tables and charts for vapours used in engineering practice.

Reference book: Elementary Engineering Thermodynamics—Young and Young.

422. Heat Engineering. R. C. Wiren.

Course 3, III Year; 2 hrs. lectures per week, both terms.

Internal Combustion Engines. Types and operation; performance and testing; basic characteristics and principles of design; carburation; fuel injection; governing.

Steam Turbines. Types and basic characteristics; condensers and auxiliaries; cooling towers.

Steam Generators and Plant. Combustion calculations; analysis of fuels and products of combustion; boiler tests and heat balance; principles of design and commercial types of boilers, furnaces, stokers, pulverised fuel equipment, economizers, air heaters, superheaters, etc.

Air Conditioning. Air and water vapour mixtures; requirements for comfort and industrial processes; the use of psychrometric charts; heat transmission calculations; heating, cooling, humidifying and dehumidifying processes; calculation of air conditioning loads; air conditioning systems and equipment.

Text books: Heat Engines—Allen and Bursley. Air Conditioning—Holmes.

Reference books: Internal Combustion Engines—Polson. Maleev. Jennings and Obert. Steam Turbines—Church. Elementary Heat Power—Solberg, Cromer and Spalding. Steam Power Stations—Gaffert. Air Conditioning Principles—Mackey. Heating and Air Conditioning—Allen, Walker and James.

423. Heat Engineering Laboratories. R. C. Wiren, F. G. Ewens, W. A. Wallace, W. T. Thompson, F. C. Hooper.

Courses 3, 5t, and 10, III Year; 1 three-hour laboratory period per week, both terms.

Course 7, III Year; 1 three-hour laboratory period per week, first term.

Course 11, III Year; 1 three-hour laboratory period per week, second term.

The laboratory work is designed to assist in clearer understanding of theory and practical applications, and consists of selected experiments in four laboratories: Heat Engine laboratory, Fuel Testing laboratory, Heat Transfer laboratory, Refrigeration and Air Conditioning laboratory.

The work on Heat Engines deals with the setting of slide valves, measuring indicated and brake horse-power, the use of power plant instruments and auxiliaries, testing of air compressors, steam engines, steam turbines and internal combustion engines under various conditions, steam calorimetry and the solution of numerous practical problems.

The Fuel Testing includes analysis of fuels and products of combustion, knock rating of gasolines, fuel calorimetry, etc.

The work on Heat Transfer deals with temperature measurement, tests on insulation and heat exchangers of various kinds.

The work on air conditioning deals with the use of instruments and charts, air conditioning standards and the solution of practical problems.

424. Heat Power Engineering. R. C. Wiren.

Courses 3 and 5t, IV Year; 2 hrs. lectures per week, both terms.

A continuation of lecture course 421 consisting of a more advanced study as applied to power plants. Properties of pure substances. Analysis and applications of the First and Second Laws. Change of phase and equations of state. Thermodynamic functions and relations as applied to a perfect gas and working fluids used in power plants. Unavailable energy and entropy. Charts and diagrams used in practice. Steam as a working fluid. Steam turbines. Power plant cycles including reciprocating engines and turbines. Cycles for high pressures and temperatures. Superheating, reheating, regenerative and binary-fluid cycles. Steam generators employing forced circulation, indirect evaporation and pressure combustion. Power plant heat balance and efficiencies.

Reference books: Heat and Thermodynamics—Zemansky. Engineering Thermodynamics—Ebaugh. Everett. Keenan. Obert. Hawkins. Steam Power Stations—Gaffert. Steam Turbines—Church.

425. Internal Combustion and Aircraft Engines. E. A. Allcut, A. B. Carr.

Courses 3 and 5t, IV Year; 1 hr. lecture per week, both terms.

The various types of internal combustion engine and their respective applications. The different cycles of operation and the avoidable and unavoidable losses. The admission, compression, combustion, expansion and exhaust operations, the factors that influence them and their application to the engine and turbine. The cooling system and its effect on thermal and mechanical conditions.

426. Heat Engineering Laboratories. R. C. Wiren, F. G. Ewens, P. B. Hughes, W. A. Wallace, F. C. Hooper.

Course 3, IV Year; 5 hrs. laboratory work per week, both terms.

Course 5t, IV Year; 6 hrs. laboratory work per week, both terms.

A continuation and extension of the work covered in the III Year laboratory subjects consisting of selected experiments in four laboratories: Heat Engine laboratory, Fuel Testing laboratory, Heat Transfer laboratory, Refrigeration and Air Conditioning laboratory.

In the Heat Engine laboratory complete tests are made of various engines such as simple, compound and uniflow steam engines, impulse and reaction type steam turbines, steam injectors, gas, oil and gasoline engines. In each case an analysis is made of the thermal cycle involved, a complete set of experiments is performed and the results plotted to show clearly to the student the effect of various alterations in adjustment on the results obtained. A complete boiler test is performed and all calculations are made for a heat balance. Problems involving variable specific heat are studied.

In the Fuel Testing laboratory the octane rating of gasoline samples is determined by A.S.T.M. methods and fuel injection spray characteristics are studied with special test equipment.

In the Heat Transfer laboratory tests are made on heat exchangers.

In the Air Conditioning and Refrigeration laboratory tests are performed on complete air conditioning systems, and complete refrigerating plants.

427. Theory of Heat Engines. R. C. Wiren.

Courses 1 and 8, III Year; Course 2, IV Year; 1 hr. lecture per week, both terms.

Thermodynamics of gases and vapours as applied to heat engine cycles and exemplified by internal combustion engines, air compressors, steam engines and turbines, and refrigerating plants.

Reference books: Elementary Engineering Thermodynamics—Young and Young. Engineering Thermodynamics—Ebaugh.

428. Heat Engine Laboratory. R. C. Wiren, W. T. Thompson.

Course 1, III Year; eight 3-hr. laboratory periods, second term.

Course 6, III Year; average 1½ hrs. laboratory per week, second term.

Course 8, III Year; 1½ hrs. laboratory per week, second term.

Course 8a, III Year; 1½ hrs. laboratory per week, second term.

Course 2, IV Year; 1½ hrs. laboratory per week, first term.

Experiments with steam and internal combustion engines, compressed air, etc.

429. Heat Transfer and Refrigeration. F. G. Ewens.

Course St, IV Year; 2 hrs. lectures per week, both terms.

Refrigeration cycles and properties of refrigerants; flow of fluids and heat transfer; heat insulation; refrigerating machines and controls; air conditioning; cold storage; ice manufacture; industrial applications of refrigeration.

Reference books: Theory of Mechanical Refrigeration—Sparks. Refrigeration Engineering—Macintire. Applied Heat Transmission—Stoever. Heating and Air Conditioning—Allen, Walker and James.

HYDRAULICS AND FLUID MECHANICS

440. Hydraulics. G. R. Lord, L. E. Jones, D. G. Huber, W. J. Laari, H. M. MacFarlane.

Courses 1, 3, 6, 7, and 11, III Year; 2 hrs. lectures per week, both terms.

Course 2, III Year; Course 8a, IV Year; 2 hrs. lectures per week, first term.

Attention is given to the development and discussion of the fundamental principles of fluid flow. These principles are illustrated by suitable practical problems connected with fluid measurements,

flow of water and other fluids in pipes, open channel computations; with a brief discussion of the resistance of submerged bodies, dimensional analysis and similarity studies.

Text book: Elementary Fluid Mechanics—Vennard.

441. Hydraulic Laboratory. G. R. Lord, L. E. Jones, D. G. Huber.

Courses 1, 3, 7, and 11, III Year; one 3-hr. laboratory period per week, second term.

Courses 2 and 6, III Year; six 3-hr. laboratory periods, first term.

Course 8a, IV Year; one 3-hr. laboratory period per week, first term.

This laboratory course is planned to illustrate the principles considered in the lecture courses in hydraulics. Experimental work in the laboratory utilizes a wide variety of apparatus and equipment concerned with fluid flow, while problems undertaken in the study room provide a link with general hydraulic practice.

442. Hydraulics. G. R. Lord.

Course 3, IV Year; 1 hr. lecture per week, both terms.

The various problems of unsteady flow such as occur in power plants, penstocks, etc. Much of the work is done by the process of arithmetic integration, and the lecture work is supplemented by problems solved by the students in the work rooms, the time for which is included in subject 444. Surges, water hammer, stream flow data, etc., are discussed.

The problems of collection of water for power purposes, use of the mass curve, rainfall and evaporation, etc., are also treated as far as possible. The flow of gases and vapours is also discussed.

443. Hydraulics. G. R. Lord.

Course 3, IV Year; 1 hr. lecture per week, first term; 2 hrs. lectures per week, second term.

Theory and design of turbines, pumps, fans, propellers, and other hydraulic machinery, as well as the application of hydraulic systems to aircraft and machine tools. The selection of turbines, pumps, and fans is dealt with, as well as problems related to the mechanical parts of hydraulic power plants. Cavitation in connection with pumps, turbines, and propellers is fully discussed.

444. Hydraulic Laboratory. G. R. Lord, L. E. Jones, D. G. Huber.

Course 3, IV Year; average of 5½ hrs. laboratory per week in 3 and 2 hr. periods, both terms.

Experimental work is carried out in the laboratory on various types of pumps, turbines, fans, centrifugal compressors and on hydraulic models. In addition computation problems involving open channel flow, water power studies, pumps and turbine studies, water hammer phenomenon and other advanced flow problems are considered. General problems involving compressibility of gases are considered.

445. Hydraulics. G. R. Lord.

Course 1, IV Year; 2 hrs. lectures per week, both terms.

General hydraulic problems such as surges in pipe lines, water hammer, flow in open channels and backwater, mass curves and a general discussion of pumps. Turbines and water power developments.

446. Hydraulic Laboratory. G. R. Lord, L. E. Jones, D. G. Huber.

Course 1, IV Year; one 3-hr. laboratory period per week, both terms.

Experimental studies of hydraulic models, turbines and pumps are carried out. Problems assigned in the study rooms deal with channel flow and other hydraulic features connected with water power installations, flood control, water supply and drainage systems.

447. Elementary Hydraulics. The Staff in Mechanical Engineering.

Courses 1, 3, 6, 7, 8, 8a, and 11, II Year; 1 hr. lecture per week, first term.

Fluid properties. Theorems of fluid statics. Pressure-density-height relationships. Measurement of pressure intensity. Fluid thrust on submerged surfaces. Buoyancy and flotation.

Text book: Elementary Fluid Mechanics—Vennard.

448. Mechanical and Thermal Measurements. The Staff in Mechanical Engineering.

Courses 2, 3, 6, 7, 9, and 11, I Year; 1 hr. lecture per week, both terms.

An introduction to common engineering quantities, and means of measuring them. Dimensions, units, standards, length, area, angle, etc. Time, speed, acceleration, etc. Mass, pressure, specific gravity, power, etc. Temperature, heat quantity, expansivity, etc.

449. Treatment of Technical Data. L. E. Jones.

Course 3, II Year; 2 hrs. lectures per week, second term.
Presentation of data; approximate nature of technical data; role played by mathematics; general numerical methods; methods of organizing data for computation; methods of analysing technical data; elements of curve-fitting and statistical treatment.

450. Hydraulics. D. G. Huber.

Course 5t, III Year; Course 5t, IV Year (1949-50 only); 1 hr. lecture per week, both terms.

A course emphasizing the fundamentals of fluid flow in pipes with special reference to refrigeration problems and including discussion of pumps.

Reference books: Elementary Fluid Mechanics—Vennard. Centrifugal Pumps and Blowers—Church. Refrigerating Data Book.

451. Hydraulics. G. R. Lord.

Course 2, IV Year; 1 hr. lecture per week, second term.

Pumping and drainage problems connected with the operation of mines and mining properties.

452. Aircraft Hydraulics. A. B. Carr.

Course 10, IV Year; 1 hr. lecture per week, first term.

A discussion of the numerous aircraft services that require remotely controlled power operation which can best be performed hydraulically. The basic principles underlying the design of aircraft hydraulic systems are considered in order that the student may understand present systems and master sufficient of the fundamental theory to enable him to follow future design.

Text book: Aircraft Hydraulics—Adams.

MACHINERY

461. Mechanical Engineering. W. G. McIntosh, A. O. Vale, J. E. K Foreman.

Course 3, II Year; 2 hrs. lectures per week, first term.

Materials of design and production methods. In addition, standards, tolerances, limits, fits, and mechanical drafting room practice will be explained.

Text books: Manufacturing Processes—Begeman. Drawings and Drafting Room Practice. A.S.A.

462. Elementary Machine Design. W. G. McIntosh, A. D. Vale, J. E. K. Foreman.

Course 6, 7, 8, and 8a, II Year; 2 hrs. lectures per week, second term.

A preparatory subject intended to familiarize the student with the different shop methods and processes, casting, forging, machining, etc., used in the production of machine parts, to enable him to make proper provision in the design of such parts to facilitate their production.

In addition, the various standards, machine and pipe threads, tapers, pipe fittings, etc., are described and mechanical drafting room practice explained. Tolerances, limits, fits and gauges are discussed.

Text book: Manufacturing Processes—Begeman. Drawings and Drafting Room Practice. A.S.A.

463. Machinery. R. T. Waines.

Course 1, III Year; 2 hrs. lectures per week, first term.

Design and selection of various machine elements, with particular reference to their application to bridges, shovels and other machinery affecting civil engineers.

Text book: Design of Machine Elements—Faires.

464. Machine Design Laboratory. W. G. McIntosh, I. W. Smith, R. T. Waines.

Course 1, III Year; 3 hrs. laboratory per week, first term.

The work in the laboratory and the drafting problems assigned will illustrate the lecture subject.

465. Theory of Machines A. I. W. Smith, O. Clodman, W. E. Morley.

Courses 3 and 10, II Year; 2 hrs. lectures per week, both terms.

A study of basic machine components, including the standard linkages, cams, gearing, and gear trains, with reference to practical applications. Methods for analysis of velocity, acceleration, and force distribution in machines. Effects of friction and determination of efficiency. The plotting and use of crank effort and torque diagrams.

Text book: Mechanism—Prageman.

466. Theory of Machines B. I. W. Smith.

Course 3, III Year; 2 hrs. lectures per week, first term.

A consideration of inertia forces and their effect in machines. Fluctuation of machine speed and its control by flywheels and governors. Balancing of rotating parts, engine balance, elementary vibration.

A working knowledge of velocity, acceleration, and force analysis is essential in this course.

Text book, Vibration; Mechanical Vibrations, Thomson.

Reference books: Theory of Machines—Angus. Mechanics of Machinery—Ham and Crane.

467. Machine Design. W. G. McIntosh.

Courses 3, 10, and 11, III Year; 2 hrs. lectures per week, both terms.

The design of various machine elements, including screw threads for fastening and power transmission, shafting, bearings (journal, thrust, ball, and roller) belts, pulleys, spur gears, flywheels, keys, clutches, etc.

Text book: Design of Machine Elements—Faires.

468. Machine Design Laboratories. W. G. McIntosh, I. W. Smith, R. T. Waines.

Course 3, III Year; an average of $7\frac{1}{2}$ hrs. laboratory per week, both terms.

Course 7, III Year; 3 hrs. laboratory per week, second term.

Course 10, III Year; 3 hrs. laboratory per week, first term; 6 hrs. laboratory per week, second term.

Course 11, III Year; 3 hrs. laboratory per week, both terms.

Design laboratory work will be taken by students in all courses listed above. This will involve the design of machine elements with the object of illustrating the work covered in the lecture subjects

in Machine Design. Sketching and drafting will be given with a view to developing the student's judgment and sense of proportion in design and the application of drafting room standards.

Mechanics of Machinery laboratory work will be taken by Course 3 only. This will include the analytical and graphical solution of problems dealing with inertia loads and stresses and the determination of speed fluctuation.

Mechanical laboratory work will be taken by Courses 3 and 10. This will include selected experiments in speed measurement, oil testing, balancing, testing of power drives, etc.

Machine and Welding Shops laboratory work will be taken by all groups. This will take the form of demonstrations of equipment in these shops with a view to assisting students in the visualization of manufacturing methods employed for parts being designed.

469. Machine Design. R. T. Waines, J. W. Church.

Courses 2, 6, 8, and 8a, IV Year; 1 hr. lecture per week, both terms.

The design of various machine elements, particularly those likely to be met with in chemical and metallurgical plants, and in mining work.

Text book: Design of Machine Elements—Faires.

470. Machine Design Laboratory. W. G. McIntosh, I. W. Smith, R. T. Waines.

Courses 2, 6, 8, and 8a, IV Year; 3 hrs. laboratory per week, second term.

Problems worked out in the laboratory, designed to give the student training in the general lay-out of shafting and plant machinery, as well as in the design of simple parts for chemical and metallurgical apparatus, and mine machinery.

471. Machine Design.

Course 5, III Year; 1 hr. lecture per week, both terms.

Some acquaintance with the selection of materials and their use in the design and construction of machinery. Machine parts are analysed as to suitable materials, production methods, and the nature and magnitude of the stresses encountered.

Text book: Design of Machine Elements—Faires.

472. Machine Design Laboratory. W. G. McIntosh, I. W. Smith, R. T. Waines.

Course 5, III Year; 3 hrs. laboratory per week, both terms.

The work in the laboratory will consist of the analytical solution of problems, illustrating the principles involved in the lecture course, and the standard practice in making assembly and detail machine drawings.

473. Machine Design. W. G. McIntosh.

Course 3, IV Year; 2 hrs. lectures per week, both terms.

This is a continuation of Subjects 467 and 466. It will involve the design of various machine elements and equipment including machine frames, hooks, hoisting equipment, crankshafts, gears (helical, herringbone, bevel, screw, and worm), springs, clutches, brakes, thin and thick wall vessels.

An introduction will be given to the study of vibration problems encountered in high speed engines and machines.

Text book: Design of Machine Elements—Faires.

474. Machine Design Laboratories. W. G. McIntosh, I. W. Smith, R. T. Waines, W. E. Morley.

Course 3, IV Year; 5 hrs. laboratory per week, first term; 6 hrs. laboratory per week, second term.

Advanced laboratory work involves both analysis and design of machine elements, machine units, and complete machines. The selection of problems is made with a view to giving the student as broad a coverage as possible and providing experience in combining of elements to form a machine of smooth and harmonious design. Some of this work will involve special shafting problems including graphical solutions, critical speeds, and multiple supports.

Work will be given in the Mechanical Laboratory on gauging and fine measurements, experimental stress analysis, vibration, and bearing testing.

475. Machine Design. I. W. Smith.

Course 7, III Year; 2 hrs. lectures per week, both terms.

Principles of stress analysis and the design of various machine elements, including screw threads, shafting, bearings, belts, gears, flywheels, etc.; also an introduction to work on speed fluctuation and balancing.

Text book: Design of Machine Elements—Spotts.

476. Manufacturing Processes. J. W. Church.

Course 11, IV Year; 2 hrs. lectures per week, both terms.

A study of metal casting, mechanical working, welding, heat treating, plastics and ply-wood moulding, finishes, machining, and mass production engineering.

477. Manufacturing Processes Laboratory. J. W. Church.

Course 11, IV Year; 3 hrs. laboratory per week, both terms.

Design of castings and forgings and the selection of suitable manufacturing processes from raw material through forming, machining, mass production tooling, gauging, and finishing.

478. Machine Design. W. E. Morley.

Course 5t, IV Year; 1 hr. lecture per week, both terms.

A series of lectures intended to supplement subject 471 of the Third Year, while co-ordinating with the Fourth Year thermo-

dynamic subjects, by presenting the overall approach employed in the design of simple power units.

MATHEMATICS

490. Calculus. I. R. Pounder, C. F. A. Beaumont, H. R. Coish, J. J. DelGrande, J. F. Hart, J. N. P. Hume, C. Kassimatis, L. Lucas, A. M. Sheppard, D. G. Wertheim.

Courses 1, 2, 3, 6, 7, 8, 8a, 9, and 11, I Year; 2 hrs. lectures per week, both terms.

Course 7, 1 Year, one 3 hr. period per week, both terms for problems.

Derivation of the fundamental formulæ of the differential and integral calculus, with early applications to simple problems concerning graphs, areas, volumes, lengths, centres of gravity, and moments of inertia. Problems are dealt with in the drafting room as outlined in subjects 275, 276, 277, 279, 280, 281, 282, and 283. For Course 7, an additional period of three hrs. per week is provided for problems and exercises, conducted by the Department of Mathematics.

491. Calculus. J. D. Burk, C. F. A. Beaumont, J. N. P. Hume, L. Lucas, A. M. Sheppard, A. E. Schild, N. Shklov, H. Sussman, D. G. Wertheim.

Courses 1, 3, 6, 7, 8, and 11, II Year; 2 hrs. lectures per week, both terms.

Course 7, II Year; one 3 hr. period per week, both terms, for problems.

Continuation of subject 490. The elementary theory reviewed and extended. Special attention to applications with problems in engineering mostly in view. Introduction to the study of simple differential equations. Problems are dealt with in the drafting room as outlined in subjects 284, 285, 286, 287, 288, and 289. For Course 7, an additional period of three hrs. per week is provided for problems and exercises, conducted by the Department of Mathematics.

492. Analytical Geometry. I. R. Pounder, C. F. A. Beaumont, J. J. DelGrande, J. F. Hart, J. N. P. Hume, C. Kassimatis, L. Lucas, A. M. Sheppard, D. G. Wertheim.

Courses 1, 2, 3, 6, 7, 8, 8a, 9, and 11, I Year; 1 hr. lecture per week, first term, 2 hrs. per week, second term.

The work in Elementary Analytical Geometry covers the more familiar propositions in connection with the straight line, circle, parabola, ellipse, and hyperbola. The subject is treated to illustrate the general methods of analytical geometry. Introduction to Analytical Geometry of Three Dimensions. In addition, problems

are dealt with in the drafting room as outlined in subjects 275, 276, 277, 279, 280, 281, 282, and 283. A part of the problem time for Course 7 listed under subject 490 is devoted to problems in analytical geometry.

493. Spherical Trigonometry. G. T. Horton.

Course 1, II Year; 1 hr. lecture per week, first term.

The derivation of formulæ and their application to the solution of triangles and to practical problems.

Text books: Spherical Trigonometry with Navy and Military Applications—Kells, Kern and Bland. Printed Lecture Notes—G. T. Horton.

494. Least Squares. O. J. Marshall.

Course 1, II Year; 1 hr. lecture per week, second term.

The general principles of probability of errors, elementary problems illustrating the application of Least Squares to the adjustment of observations, impirical constants and formulæ.

Text books: Least Squares in Engineering—Coddington and Marshall. Printed Lecture Notes—O. J. Marshall and G. T. Horton

495. Mathematical Problems. Mrs. I. Brauer, Mrs. H. Infeld, J. A. Rottenberg.

Courses 5 and 10, II Year; 3 hrs. problems per week, both terms.

The weekly sheet of prepared problems will be based on the content of courses 504, 506, 507, and will provide training in operating the routine processes of the Calculus and will illustrate these by applications to Mechanics and Geometry. Students will be given an opportunity to have their difficulties in these courses cleared up.

502. Algebra and Calculus. T. E. Hull.

Courses 5 and 10, I Year; $3\frac{1}{2}$ hrs. lectures per week, both terms.

Polynomials and rational functions, elementary theory of equations, inequalities, determinants, limits, summation of series, binomial, exponential, and logarithmic series, expansions of the circular and hyperbolic functions and their inverses, the methods and operations of the Calculus considered intuitively and illustrated by applications, elementary differential equations.

Text books: Calculus—Sherwood and Taylor. Introduction to the Calculus—Beatty and Jenkins.

503. Analytical Geometry of the Plane. T. E. Hull.

Courses 5 and 10, I Year; $1\frac{1}{2}$ hrs. lectures per week, both terms.

Cartesian and polar coordinates, transformation of coordinates, straight lines and curves of the second degree, projective properties of conics, the principle of duality, higher plane curves.

Text book: Analytical Geometry—Nowlan.

504. Differential Calculus. Mrs. I. Brauer.

Courses 5 and 10, II Year; 3 hrs. lectures per week, both terms.

Differentiation, Taylor's theorem and series for functions of one or more variables, families of curves and surfaces and their differential equations, Jacobians, geometrical and mechanical applications.

Text book: Advanced Calculus—Sokolnikoff.

505. Integral Calculus and Differential Equations. Mrs. H. Infeld.

Courses 5 and 10, II Year; 3 hrs. lectures per week, both terms.

The indefinite integral, integration of rational and other special functions, the definite integral, differentiation with respect to a parameter, multiple integration, Fourier's series, geometrical and mechanical applications, approximate integration, introduction to ordinary differential equations.

Text book: Advanced Calculus—Sokolnikoff.

506. Analytical Geometry of Space. J. A. Rottenberg.

Courses 5 and 10, II Year; 1 hr. lecture per week, both terms.

Cartesian and other systems of point coordinates, curves and surfaces and their equations in parametric or non-parametric form, data fixing planes, lines, conics, and quadrics, generating lines and circular sections of quadrics, classification of quadrics, tangent cones to quadrics, metric and projective properties of quadrics, families of quadrics, ruled surfaces and surfaces of revolution.

Text book: Coordinate Geometry—Eisenhart.

507. Differential Equations. I. R. Pounder, D. A. F. Robinson, D. B. Sumner.

Course 1, III Year; 1 hr. lecture and 1 hr. problem work per week, both terms.

First order equations solvable by quadratures, linear equations of first and second order, linear equations with constant coefficients of higher order, solution in series, Fourier's series.

Text books: Elementary Differential Equations—Kells. Differential Equations—Reddick.

508. Theory of Functions. W. J. Webber, I. R. Pounder, D. B. Sumner.

Courses 5 and 10, III Year; 1 hr. lecture and 1 hr. problem work per week, both terms.

Complex numbers, limits and series, analytic functions, Cauchy's theorem, Taylor and Laurent series, singularities and their significance, analytic continuation, contour integration, conformal mapping of one plane region on another.

Text books: Functions of a Complex Variable—Phillips. Theory of Functions—Copson. Theory of Functions as applied to Engineering Problems—Rothe, Ollendorff, and Pohlhausen.

509. Differential Equations. J. D. Burk.

Courses 5 and 10, III Year; 1 hr. lecture and 1 hr. problem work per week, both terms.

First order equations solvable by quadratures, depression of the order, the linear equation, the linear equation with constant coefficients, operator methods, the linear partial differential equation, particular equations of the second order.

Text books: Differential Equations—Piaggio. Intermediate Differential Equations—Rainville. Fourier Series and Boundary Value Problems—Churchill.

MATHEMATICS, APPLIED

520. Theoretical Mechanics. A. E. Schild.

Course 5, III Year; 1 hr. lecture and 1 hr. problem work per week, both terms.

A systematic application of mathematical methods to the solution of problems in mechanics, with emphasis on general principles. The problems deal chiefly with the plane motion of particles and rigid bodies. Lagrange's equations are introduced.

Text book: Principles of Mechanics—Synge and Griffith.

521. Differential Equations of Mathematical Physics. A. F. Stevenson.

Courses 5 and 10, IV Year; 2 hrs. lectures per week, both terms.

The underlying theory and important particular equations, including eigenvalues and eigenfunctions, Fourier series, spherical and cylindrical harmonics, vibration of strings, membranes, and rods, sound waves, water waves, equation of heat conduction.

METALLURGY

530. Metallurgy. L. M. Pidgeon, B. Chalmers.

Course 8, II Year; 1 hr. lecture per week, both terms.

Courses 2 and 9, III Year; 1 hr. lecture per week, first term.

An introductory course describing the theory and practice of metallurgical operations, and principles of physical metallurgy.

531. Fuels and Combustion. H. U. Ross.

Courses 8 and 8a, II Year; 1 hr. lecture per week, both terms.

Fuels, their use, preparation, calorific value, and combustion.

532. Physical Metallurgy I. B. Chalmers, B. M. Thall.

Course 11, II Year; Course 3, III Year; 1 hr. lecture per week, both terms.

A general course in Physical Metallurgy, dealing with the structure of metals and alloys, with special reference to the ferrous and non-ferrous alloys of practical importance. The influence of mechanical deformation, heat treatment and composition on the structure is considered, and the relation between the structure and the mechanical properties is examined.

534. Metallurgy. L. M. Pidgeon.

Course 8, III Year; 2 hrs. lectures per week, first term; 1 hr. lecture per week, second term.

A general discussion of the fundamental principles of extractive metallurgy, including the production of the more important metals.

Metallurgical problems are included in this course.

535. Metallurgy Laboratory. J. E. Toomer.

Course 8, III Year; 6 hrs. continuous laboratory per week, both terms.

Experiments in roasting, smelting, leaching, and retorting designed to illustrate the principles underlying these operations.

536. Principles of Physical Metallurgy. B. Chalmers.

Course 8, III Year; 2 hrs. lectures per week, both terms.

One hour lecture per week in first term consists of a series of lectures on the structure of solids, with particular reference to x-ray methods of investigation.

537. Physical Metallurgy Laboratory. B. Chalmers, B. M. Thall.

Course 8, III Year; 3 hrs. laboratory per week, both terms.

Practical work relating to subject 536.

538. Metallurgy. L. M. Pidgeon.

Course 2, IV Year; 1 hr. lecture per week, both terms.

The extractive metallurgy of the common metals, together with the calculations necessary to understand the metallurgical processes.

539. Metallurgy Laboratory. J. E. Toomer.

Course 2, IV Year; 6 hrs. continuous laboratory per week for one half of second term.

Similar to subject 535.

540. Metallurgy Problems. L. M. Pidgeon, H. U. Ross.

Course 8, IV Year; 2 hrs. lectures per week, both terms.

Problems of chemical reactions, thermochemistry, electrolysis, vapor pressure, transmission of heat, etc.

541. Metallurgy Laboratory. J. E. Toomer.

Course 8, IV Year; 6 hrs. continuous laboratory per week, first term; 3 hrs. laboratory per week, second term.

Metallurgical analysis of ores, furnace products, and alloys.

542. Non-Ferrous Production Metallurgy. L. M. Pidgeon.

Course 8, IV Year; 2 hrs. lectures per week, both terms.

Extractive metallurgy of the non-ferrous metals, including electrometallurgy.

543. Physical Metallurgy. B. Chalmers.

Course 8, IV Year; 2 hrs. lectures per week, both terms.

A continuation of subject 536.

544. Physical Metallurgy Laboratory. B. Chalmers, B. M. Thall.

Course 8, IV Year; 6 hrs. laboratory per week, first term; 3 hrs. laboratory per week, second term.

Practical work relating to subject 543.

546. Physical Metallurgy. B. Chalmers, B. M. Thall.

Course 1, III Year; 1 hr. lecture per week, first term.

A short course on the influence of heat and mechanical treatment on the structure and properties of steels and the more important non-ferrous alloy.

547. Physical Metallurgy 2. B. Chalmers, B. M. Thall.

Courses 3 and 11, IV Year; 1 hr. lecture per week, both terms.

A continuation of subject 532.

548. Physical Metallurgy Laboratory. B. Chalmers, B. M. Thall.

Courses 3 and 11, IV Year, 1½ hrs. laboratory per week, second term.

A practical course illustrating the principles dealt with in subjects 532 and 547.

549. Physical Metallurgy. B. Chalmers., B. M. Thall.

Courses 5, 7, and 8a, III Year; Courses 2, 9, and 10, IV Year; 1 hr. lecture per week, both terms.

A short course in Physical Metallurgy; structure of metals and alloys; effects of mechanical distortion and heat treatment on structure; relation between structure and mechanical properties; and properties of some steels and non-ferrous alloys.

550. Metallurgical Theory. W. C. Macdonald.

Course 8, IV Year; 1 hr. lecture per week, both terms.

A study of equilibria at high temperatures in production metallurgy.

552. Ferrous Production Metallurgy. H. U. Ross.

Course 8, IV Year; 1 hr. lecture per week, both terms.

Production metallurgy of iron and steel.

CERAMICS

560. Ceramic Minerals and Calculations. P. M. Corbett, B. Chalmers, J. E. Toomer.

Course 8a, III Year; 4 hrs. lectures per week, first term; 2 hrs. lectures per week, second term.

Industrial classification, properties, and utilization of non-metallic minerals. Ceramic plant practice is covered in some detail in the second term. One hour per week first term to be devoted to a joint lecture with subject 536 on structure of solids.

561. Heavy Clay Products Laboratory. P. M. Corbett.

Course 8a, III Year; 5 hrs. laboratory per week, first term; 7 hrs. laboratory per week, second term.

The physical properties and thermal characteristics of non-metallic minerals are studied from an industrial standpoint.

562. Ceramics. P. M. Corbett.

Course 8a, III Year; 2 hrs. lectures per week, second term.

The composition of clear and coloured glazes.

564. Ceramics Laboratory. J. E. Toomer.

Course 8a, III Year; $6\frac{1}{2}$ hrs. laboratory per week, first term; 7 hrs. laboratory per week, second term.

Practice in the analysis of non-metallic minerals.

565. Refractories and Ceramic Bodies. P. M. Corbett.

Course 8a, IV Year; 2 hrs. lectures per week, first term; 1 hr. lecture per week, second term.

Composition of bodies made by using non-metallic minerals, with special reference to refractories, whiteware, and porcelain.

566. Glass and Enamels. P. M. Corbett.

Course 8a, IV Year; 1 hr. lecture per week, both terms.

Composition and manufacture of glass and iron enamels.

568. Whitewares and Enamels Laboratory. P. M. Corbett.

Course 8a, IV Year; 6 hrs. laboratory per week, both terms.

Advanced work on the compounding and testing of non-metallic mineral products.

572. Introductory Ceramics. P. M. Corbett.

Course 8a, II Year; 2 hrs. lectures per week, first term.

A descriptive course to cover all the branches of the ceramic industry.

573. Refractories in Metallurgy. P. M. Corbett.

Course 8, III Year; 1 hr. lecture per week, both terms.

Theories and applications of refractories in metallurgical processes.

GEOLOGICAL SCIENCES

MINERALOGY AND PETROGRAPHY

580. Elementary Mineralogy. W. M. Tovell.

Courses 2 and 9, II Year; 2 hrs. lectures per week, first term.

Course 5g, III Year; 2 hrs. lectures per week, first term.

An introductory course in general and descriptive mineralogy.

Text book: Dana's Manual of Mineralogy—Hurlbut.

581. Elementary Mineralogy Laboratory. E. W. Nuffield, W. M. Tovell.

Courses 2 and 9, II Year; 1 hr. laboratory per week, first term.

Course 5g, III Year; 1 hr. laboratory per week, first term.

A practical course to accompany subject 580.

Reference book: Dana's Manual of Mineralogy—Hurlbut.

583. Introductory Mineralogy. W. M. Tovell.

Courses 6 and 8a, I Year; 2 hrs. lectures and laboratory per week, second term.

A brief study of the common minerals.

Reference book: Dana's Manual of Mineralogy—Hurlbut.

585. Lithology. W. M. Tovell.

Courses 2 and 9, II Year; Course 5g, III Year; 1 hr. lecture and laboratory per week, both terms.

A macroscopic study of rock-forming minerals and rocks.

Text book: Handbook of Rocks—Kemp-Grout.

587. Determinative Mineralogy. W. M. Tovell.

Courses 2 and 9, II Year; 2 hrs. laboratory per week, first term.

Determination of minerals by means of the blowpipe and from physical properties.

Reference book: Dana's Manual of Mineralogy—Hurlbut.

589. Elementary Optical Mineralogy. V. B. Meen.

Courses 2 and 9, II Year; Course 8a, III Year; 1 hr. lecture and laboratory per week, second term.

Reference book: Optical Mineralogy—Rogers and Kerr.

590. Petrology Laboratory. V. B. Meen.

Course 2, III Year; 2 hrs. laboratory per week, s cond term.

Continuation of subject 585, with some consideration of the microscopic properties of minerals and rocks.

Text book: Petrology for Students—Harker.

592. Lithology. V. B. Meen.

Course 1, III Year; 2 hrs. lectures and laboratory per week, first term.

A study of rocks and rock-forming minerals.

Text book: Handbook of Rocks—Kemp-Grout.

594. Petrography. W. W. Moorhouse.

Course 9, III Year; 1 hr. lecture per week, both terms.

Course 5g, IV Year; 2 hrs. lectures per week, both terms.

Microscopic characters of the rock-forming minerals in thin sections, and description and classification of rocks, continuing subjects 585 and 589.

Text books: Optical Mineralogy—Rogers and Kerr. Petrology for Students—Harker.

595. Petrography Laboratory. W. W. Moorhouse.

Course 9, III Year; Course 5g, IV Year; 2 hrs. laboratory per week, both terms.

Microscopic petrography, to accompany subject 594.

Text books: As in subject 594.

596. Optical Mineralogy Laboratory. M. A. Peacock.

Course 8a, II Year; 2 hrs. laboratory per week, first term.

Course 9, IV Year; 2 hrs. laboratory per week, first term.

Determination of the non-opaque minerals by the immersion method.

Reference books: Optical Crystallography—Wahlstrom. The Microscopic Determination of the Non-opaque Minerals—Larsen and Berman.

597. Mineralography Laboratory. A. R. Graham.

Course 9, IV Year; 2 hrs. laboratory per week, both terms.

A study of the common ore minerals in polished sections.

Reference book: Microscopic Determination of the Ore Minerals—Short.

598. Morphological Crystallography. M. A. Peacock.

Course 5s, IV Year; 1 hr. lecture per week, both terms.

A course on the thirty-two crystal classes, with reference to natural and artificial crystals.

Text book: The Form and Properties of Crystals—Dale.

MODERN LANGUAGES

610. English. W. J. T. Wright.

Courses 1, 2, 3, 5, 6, 7, 8, 8a, 9, 10, and 11, I Year; 1 hr. lecture per week, both terms.

The expression of ideas and the compilation and writing of engineering reports and letters; technical exposition; the necessity of accurate expression in professional writing; the value of reading.

613. German. T. Hedman.

Course 6, II Year; 1 hr. lecture per week, both terms.

614. German. T. Hedman.

Course 6, III Year; 1 hr. lecture per week, both terms.

An advanced course in scientific German.

615. German. T. Hedman.

Course 6, IV Year; 1 hr. lecture per week, both terms.

An advanced course in scientific German. Translation of scientific articles and treatises.

PHYSICAL TRAINING

640. Physical Training.

All courses, I and II Years.

The requirements for Physical Training are outlined in Section XIV.

PHYSICS

650. Properties of Matter; Mechanics and Heat. J. Convey, J. Reekie.

Courses 5, 8, 8a, and 10, I Year; 4 hrs. lectures per week, both terms.

In addition to the work in the divisions indicated in the title, the subject also includes lectures and problems on calculations for science students involving curve plotting and curve fitting, and the use of the elementary calculus and statistics.

Reference books: Dynamics—Duncan and Starling. Mechanics of Fluids—Barton. Mechanics—Sears. Properties of Matter—Wagstaff. Heat—Stewart and Satterly (ed. Archer). Heat—Noakes. Mathematical and Physical Tables—Clark. Calculus Made Easy—Thompson. Theory of Measurements—Tuttle and Satterly.

651. Properties of Matter; Mechanics and Heat Laboratory. J. Convey.

Courses 5, 8, 8a, and 10, I Year; 3 hrs. laboratory per week, both terms.

Supplementary to subject 650.

652. Elementary Magnetism and Electricity. J. Reekie.

Courses 5 and 10, II Year; 1 hr. lecture per week, first term; 2 hrs. lectures per week, second term.

Fundamental theory of magnetism and electricity, including the introduction of electron theory and alternating currents.

Reference books: Advanced Text-book of Magnetism and Electricity—Hutchinson. Electricity and Magnetism—Starling.

653. Elementary Light. J. Convey.

Courses 5 and 10, II Year; 1 hr. lecture per week, both terms.

Fundamental theory of light, including treatment of interference, diffraction, polarized light, and the introduction of geometrical optics.

Reference books: Light for Students—Edser. Introduction to Physical Optics—Robertson. Optical Measuring Instruments—Martin.

654. Acoustics. J. Convey.

Courses 5 and 10, II Year; 1 hr. lecture per week, first term.

Fundamental theory of acoustics, including elementary treatment of architectural acoustics.

655. Physics Laboratory (Magnetism and Electricity, Light and Acoustics).

Course 5, II Year; 6 hrs. laboratory per week, first term; 3 hrs. laboratory per week, second term.

Course 10, II Year; 3 hrs. laboratory per week, first term; 6 hrs. laboratory per week, second term.

Work carried out under the direction of the staff in Physics, covering lectures dealt with in subjects 652, 653 and 654.

656. Mathematical Methods in Physics I. H. L. Welsh.

Course 5, III Year; 1 hr. lecture per week, both terms.

Analysis of scalar and vector fields with applications to mechanics and hydromechanics. Complex numbers and their use in two-dimensional theory of fields and in problems of mechanical vibrations.

657. Properties of Matter. John Satterly.

Course 5, III Year; 2 hrs. lectures per week, both terms.

Advanced work on properties of matter, dealing with gravitation, elasticity, viscosity, surface tension, and kinetic theory of gases.

Reference books: Properties of Matter—Poynting and Thomson General Properties of Matter—Newman and Searle. Applied

Mathematics—Perry. Experimental Physics—Searle. Practical Physics—Watson. The Mechanical Properties of Fluids—Drysdale and others.

658. Heat. John Satterly.

Course 5, III Year; 1 hr. lecture per week, both terms.

Thermometry and pyrometry; absolute scale of temperature, mechanical equivalent of heat, kinetic theory of gases, equations of state, low temperature work, specific heats, vaporization, fusion, expansion, transfer of heat by conduction and convection; radiation and radiation pyrometry, the second law of thermodynamics and its simple applications.

Reference books: Heat and Thermodynamics—Roberts. Methods of Measuring Temperature—E. Griffiths. A Textbook on Heat. Parts I and II—Allen and Maxwell.

659. Physical Laboratory.

Course 5, III Year; 3 hrs. laboratory per week, both terms.

Experiments illustrating the principles involved in the two preceding subjects.

660. Optics. R. Richmond.

Courses 5i and 5s, III Year; 1 hr. lecture per week, both terms.

Optics. The theory of paraxial rays and aberrations in optical instruments. Theory of prism spectrographs: dispersion, resolving power, and light power.

Reference books: Applied Optics and Optical Design, Part One—Conrady. The Principles of Optics—Hardy and Perrin. Fundamentals of Optical Engineering—Jacobs. Experimental Spectroscopy—Sawyer.

661. Optics. R. Richmond.

Courses 5i and 5s, III Year; 3 hrs. laboratory per week, first term.

Supplementary to subject 660.

663. Atomic Physics. Miss E. J. Allin, H. J. C. Ireton, H. L. Welsh.

Courses 5e, 5i, and 5s, IV Year; 2 hrs. lectures per week, both terms.

Introduction to quantum theory, atomic, molecular and nuclear physics.

Text books: Introduction to Modern Physics—Richtmyer and Kennard. The 'Particles' of Modern Physics—Stranathan.

664. Mathematical Methods in Physics II. C. Barnes.

Courses 5e, 5s, and 5i, IV Year; 2 hrs. lectures per week, both terms.

Vibrations of systems of one and two degrees of freedom. Formulation of general laws of fluid motion, elasticity, wave propagation, and heat conduction. Application of function theory, Cartesian tensors, and calculus of variations in classical problems.

665. Physical Laboratory. H. J. C. Ireton.

Course 5e, IV Year; 3 hrs. laboratory per week, both terms.

Course 5s, IV Year; 9 hrs. laboratory per week, first term; 12 hrs. laboratory per week, second term.

Accompanying the lecture subjects 663, 664, 666, and 669.

666. Advanced Optics. M. F. Crawford.

Course 5s, IV Year; 2 hrs. lectures per week, second term.

Diffraction, interference, and polarisation.

Text books: Physical Optics—Wood. Diffraction of Light, X-Rays, etc.—Meyer. Applications of Interferometry—Williams. Cours d'Optique—Bruhat.

667. Theory of Potential. C. Barnes.

Course 5e, III Year; 1 hr. lecture per week, both terms

The theory of the Newtonian potential leading to the solution of simple boundary-value problems connected with the Laplace equation in gravitation, electrostatics, and heat conduction.

669. Analysis of Materials by Spectrographic and X-Ray Methods.

Course 5s, IV Year; 1 hr. lecture per week, both terms.

Qualitative and quantitative methods of spectro-chemical analysis of materials. The physical properties of X-rays, their production and applications to crystal structure.

Reference books: Applied X-Rays—Clark. Chemical Spectroscopy—Brode. Optical Methods of Chemical Analysis—Gibb.

670. Exploration Geophysics. A. A. Brant, J. H. Hodgson.

Course 5g, IV Year; 2 hrs. lectures per week, both terms.

Physical principles underlying geophysical methods used in locating mineral deposits. Particular attention is given to magnetic, electrical, electromagnetic, gravitational, seismological, theremometric, and radioactive methods.

Reference books: Geophysical Exploration—Heiland. Exploration Geophysics—Jakosky. Imperial Geophysical Exploration Survey, Broughton—Edge and Laby. Applied Geophysics—Eve and Keys.

671. Exploration Geophysics. A. A. Brant, J. H. Hodgson.

Course 9, IV Year; 1 hr. lecture per week, both terms.

Elementary physical principles underlying geophysical methods used in locating mineral deposits. Particular attention is given to magnetic, electrical, electromagnetic, gravitational, seismological, theremometric, and radioactive methods.

Reference books: Geophysical Exploration—Heiland. Exploration Geophysics—Jakosky. Imperial Geophysical Exploration Survey, Broughton—Edge and Laby. Applied Geophysics—Eve and Keys.

672. Geophysics. A. A. Brant, J. H. Hodgson.
Course 5g, IV Year; 6 hrs. laboratory per week, both terms.
A laboratory course accompanying subject 670.

673. Geophysics. A. A. Brant, J. H. Hodgson.
Course 9, IV Year; 3 hrs. laboratory per week, both terms.
A laboratory course accompanying subject 671.

674. Physical Laboratory. H. J. C. Ireton.
Course 5i, IV Year; 3 hrs. laboratory per week, both terms.
Accompanying subject 663.

675. Physics of the Earth. J. T. Wilson, J. H. Hodgson.
Course 5g, IV Year; 2 hrs. lectures per week, both terms.
Basic considerations of gravitation; the figure of the earth and isostacy; terrestrial magnetism and atmospheric electricity; seismology; internal structure and constitution of the earth; radioactivity, geothermal heat and the age of the earth.

676. Electronics. G. E. Reesor.
Course 5g, IV Year (1949-50 only); 3 hrs. laboratory per week, both terms.
Theory and application of electron tube circuits.

PRACTICAL EXPERIENCE

690. Practical Experience.
Course 1.
Every student in Civil Engineering is urged to obtain the maximum amount of practical experience possible, during the summer vacations of his course. He must, before graduation, present satisfactory evidence of having had an experience of at least 600 hours on work acceptable to the Department.

691. Practical Experience.
Course 2.
Every student in Mining Engineering is required to present, before graduation, satisfactory evidence of having had at least six months' practical experience in work connected with Mining, Metallurgy, or Geology, for which he must have received regular wages.

The time may be spent in geological survey, ore dressing, smelter, or lixiviation works, in prospecting, or on any work in or about a mine other than as an office man or clerk. Prospecting will count only one-half (e.g., four months' prospecting will be counted as two months) and must not be submitted for more than three of the six months. Not more than three months on geological surveys or in assaying will be accepted as part of the six months. It is important to note that this experience may be obtained before the student is admitted to the University.

692. Practical Experience.

Course 3.

Every student in Mechanical Engineering is required to spend 1200 hours in mechanical work satisfactory to the Department. Half of this work is required to be done before February of his Third Year and the balance before February of his Fourth Year. Proof is to be given the Department before the dates mentioned.

All or any part of this shop work may be completed before the student enters the University, and he is urged to complete all of it at as early a date in his course as possible.

Failure to meet the specified requirements within the time set will result in a condition in shop work.

Certificate forms for this work may be obtained from the Department of Mechanical Enginerring.

(*a*) Third Year—600 hours.

The student is required to obtain this practical experience in industry, preferably in the foundry, the forge shop, and the machine shop. Such work assists the students in his understanding of the lecture and laboratory work throughout his entire course in Mechanical Engineering, and particularly the design work in his Third and Fourth Years.

Instruction regarding the type of work which is acceptable, and any special requirements, will be given by the Department to the student during his Second Year.

(*b*) Fourth Year—the balance of 1200 hours.

This is a continuation of the work outlined for the Third Year.

Instruction regarding the type of work which is acceptable, and any special requirements, will be given by the Department to the student during his Third Year.

695. Practical Experience.

Course 7.

Every student in Electrical Engineering is required to submit, before graduation, satisfactory evidence of having had at least 1200 hours' experience in work connected with engineering practice. Certificate forms may be obtained from the Department of Electrical Engineering and the completed certificates should be returned to the Department as soon as possible after the completion of each period of work.

696. Practical Experience.

Course 9.

Every student in Mining Geology is required to submit, before graduation, satisfactory evidence that he has spent at least six months in field work. This may consist of prospecting, development or underground work or service on geological field parties, and at least half of the time should be spent underground.

698. Practical Experience.

Course 11.

Each student in this course is required to spend 1200 hours doing practical work, before graduation. This time should preferably be spent in the actual performance of manufacturing or constructional operations in industrial plants or engineering enterprises. Such experience will be valuable in promoting a better understanding of lectures and laboratory work and will assist the student in appreciating the workers' viewpoint.

SURVEYING

All students taking Field Work in Courses 710 to 720, inclusive, will be required to use Departmental Field Books.

710. Surveying. W. M. Treadgold, O. J. Marshall, T. L. Rowe, H. L. Macklin, G. T. Horton.

Courses 1, 2, 3, 5, 6, 7, 8, 8a, 9, 10, and 11, I Year; 1 hr. lecture per week, first term.

General principles and practice of surveying with the chain, the transit, and the level, with special attention given to co-ordinative surveying.

Text books: Plane Surveying—Tracy. Elementary Surveying—Breed and Hosmer. Surveying—Breed. Printed Notes on Elementary Surveying—The Staff in Surveying.

712. Field Work. W. M. Treadgold, O. J. Marshall, T. L. Rowe, H. L. Macklin, G. T. Horton.

Courses 1, 2, 3, 5, 6, 7, 8, 8a, 9, 10, and 11, I Year; 3 hrs. per week, first term.

Practice in chaining; a complete survey of a piece of land with the chain and transit; keeping of field notes; the use of the transit in surveying closed figures and traverse lines, and in ranging straight lines; plotting by latitudes and departures and otherwise computing areas; instrumental work with the level; use of level and transit in setting out a proposed building and calculating the volume of excavations required.

714. Surveying. G. T. Horton.

Course 1, II Year; 1 hr. lecture per week, both terms.

Simple, reverse, compound and spiral curves as applied to highway and railroad surveying. Theory of measurements as applied to precise measurements in surveying. Main features of mine and hydrographic surveying.

Text books: Railroad Curves and Earthwork (with Tables)—Allen. Printed Lecture Notes—G. T. Horton.

715. Surveying. H. L. Macklin.

Courses 2 and 9, II Year; 1 hr. lecture per week, both terms.

Mine surveying, with problems related thereto. Simple curves, stadia and plane table topographical surveying.

Text books: Surveying—Breed and Hosmer. Mine Surveying—Durham. Introduction to Mine Surveying—Staley.

716. Field Work. W. M. Treadgold, O. J. Marshall, G. T. Horton.

Course 1, II Year; 8 hrs. per week, first term.

Adjustments of the transit and level, minor problems in triangulation and traversing, levelling and curves.

717. Field Work. H. L. Macklin.

Courses 2 and 9, II Year; 6 hrs. per week, first term.

Adjustments of the transit and level, minor problems in triangulation and traversing, levelling, curves and topography.

718. Construction Surveying. W. M. Treadgold.

Course 1, III Year; 1 hr. lecture per week, both terms.

Construction surveys are taken up under the following headings, and the work is treated as applying equally to railroads, highways, canals, transmission lines, etc.

Earthwork:
(*a*) Cross sectioning.
(*b*) Computation of volume.
(*c*) Mass or haul diagram.

Transition and Vertical curves (including super-elevation).
Railway turnouts and sidings.
Layout of roads and sewers.

Text books: Field Engineering—Searles. Railroad Curves and Earthwork—Allen. Route Surveying—Pickles and Wiley. Printed Notes—W. M. Treadgold.

719. Geodesy and Map Projections. O. J. Marshall.

West Indies Surveyors; 1 hr. lecture and 2 hrs. laboratory per week, second term.

Elementary geodesy, figure of the earth, spherical excess, etc. Computation of geographic position and plane co-ordinates on typical systems of map projections.

720. Survey Camp. W. M. Treadgold, O. J. Marshall, J. W. Melson, T. L. Rowe, H. L. Macklin, G. T. Horton, G. B. Langford, W. W. Moorhouse.

Courses 1, 2, and 9, III Year.
Course 1 . . . . Aug. 20 to Sept. 17—Dorset.
Courses 2 and 9 . . . . . Aug. 20 to Sept. 17—Gull Lake.

Course 1:
(*a*) Secondary Triangulation and Base Line Measurements.
(*b*) Highway and Railway Location.
(*c*) Cross Sectioning and Computation of Earthwork.
(*d*) Stadia and Plane Table Topography.
(*e*) Observations for Time, Azimuth, and Latitude.

Courses 2 and 9:

(*a*) Stadia and Plane Table Topography.

(*b*) Mine Surveying, using overhead stations.

(*c*) Shaft plumbing and use of Auxiliary Telescope.

(*d*) Geological Surveying and mapping.

Students in Courses 1, 2, and 9 will be required to take the Survey Camp between the Second and Third Years; on failure to do so, this subject will be carried as a supplemental in the Third Year.

THESIS

730. Thesis.

Course 1, IV Year; 2 hrs. per week, second term.

Each student of the Fourth Year, Course 1, is required to prepare and present a thesis on an approved subject, in both oral and written form. Instructions regarding the form of the thesis, and the selection of subject, are given to students at the end of their Third Year. The written thesis must be submitted not later than the last day of the Fall term of the Fourth Year of study. Oral presentation of the theses is arranged for the Spring term during regularly assigned lecture periods.

731. Thesis.

Course 2, IV Year.

Each student is required to prepare a thesis on a subject approved by the Head of the Department of Mining Engineering. Instructions regarding this thesis will be given to the students at the end of the Third Year.

732. Thesis.

Course 3, IV Year.

Printed instructions regarding thesis requirements are issued to each student by the Department of Mechanical Engineering, giving full particulars.

733. Thesis Seminar.

Course 5, IV Year.

Each student in the Fourth Year will be required to prepare a thesis on a subject approved by the Committee Administering the Course in Engineering Physics.

734. Thesis.

Course 6, IV Year.

In this subject to which about one-third of the time of the year is devoted, each student is assigned a research problem by a member of the staff, under whose direction he carries out the necessary laboratory work. This involves a search of the chemical literature respecting the problem, and devising experimental procedures. At the end of the session a thesis is written embodying the results of his search of the original literature and his own experimental work.

This is intended to require the student, on an individual basis, to apply the knowledge gained in his previous courses, and to encourage the development of initiative. Also, for those students who go on to the Graduate School or into industrial research, it is intended as a preliminary training.

In those cases where in the opinion of the staff it would be advantageous for the student to do his research work in a closely allied field, such as electrochemistry, metallury, applied physics, etc., the Department will make the necessary arrangements, where possible, with the other Departments concerned.

735. Thesis.

Course 7, IV Year.

Each student is required to prepare a thesis on a subject approved by the Head of the Department of Electrical Engineering. Instructions regarding the form of the thesis will be given to the students at the end of the Third Year.

736 Thesis.

Course 8, IV Year.

Each student in the Fourth Year must prepare a thesis on a subject and in a form approved by the Head of the Department of Metallurgical Engineering. This thesis is based upon library and laboratory work.

737. Thesis.

Course 8a, IV Year.

A written report of approximately 6000 words, on a subject approved by the Department. Material for this report is obtained from laboratory and library work, which is carried out under the supervision of a member of the staff.

738. Thesis.

Course 9, IV Year; 6 hrs. per week, both terms.

A report on an investigation made by the student. It is intended to test his ability to make an independent field or laboratory study of some geological problem. The problem chosen must be approved by the Committee Administering the Course in Mining Geology, and plans for the thesis completed not later than November 1st of the student's Fourth Year.

739. Thesis.

Course 10, IV Year.

Each student of the Fourth Year must prepare a written thesis on an approved subject of a length not less than 6000 words. This thesis is to be finished and submitted for binding on or before January 15th.

740. Thesis.

Course II, IV Year.

Each student in the Fourth Year, Course 11, is required to prepare and present, in both oral and written form, a thesis on an approved subject in the field of management. Instructions regarding the form of the thesis and the selection of subject are given toward the end of the Third Year.

SECTION X. EXAMINATIONS

ANNUAL EXAMINATIONS

1. Annual examinations will be held in April except as provided in paragraph 2 below.

2. Annual examinations will be held at the beginning of the second term in all subjects completed during the first term.

3. Promotions from one year to another are made on the results of term work and the annual examinations. A student proceeding to a degree must pass in all term work and examinations in all subjects of his course, and at the periods arranged by the Council.

4. The pass marks required on written examinations and laboratory work of all departments are 50 per cent, with an average of 55 per cent on written examinations and an average of 55 per cent on laboratory work. Candidates who have attained the required average and who have failed in not more than two subjects will be required to pass supplemental examinations in those subjects to secure pass standing.

5. Honours will be granted a student who, at the Annual Examinations, passes in all written and laboratory subjects, and who also obtained 75 per cent of the total number of marks allotted to the subjects in his course.

6. Honour graduate standing will be granted to those who obtain honours in the final year and in one previous year.

7. Candidates who fail to secure promotion in the First and Second Years will not be allowed to repeat the work of the year until at least one academic year has elapsed.

8. A student who fails in the work of any year may petition the Council to be allowed to repeat the work of the year. If the petition is granted registration will be provisional only and will be so endorsed on his registration card.

9. A student will not be allowed to repeat the work of more than one year in his entire undergraduate course.

10. Candidates who are repeating the work of any year will be required to take again the whole course of instruction in the year in which they fail before presenting themselves a second time for examination.

11. A student who, in either term of the session, fails to perform satisfactorily the work of his course may not be allowed to present himself at the final examinations of the year.

12. A student should submit to Council immediately after its occur; rence, evidence of any illness or mishap which occurs during the session-any petition for leniency on account of such incidents may be refused consideration if received after the third day following the last day of examinations.

13. A student who has failed to complete satisfactorily the course in Physical Education prescribed for the First Year will not be permitted to

register in the Third Year; and a student who has failed to complete satisfactorily the course in Physical Education prescribed for the Second Year will not be permitted to register in the Fourth Year.

14. A student will not be allowed to write any examinations if he has not paid all fees and dues for which he is liable at that time.

SUPPLEMENTAL EXAMINATIONS

1. The supplemental written examinations will begin on the 29th day of August, 1949. Application (on the prescribed form) to take such examinations, including practical ones, must be received from the candidate by the Secretary of the Faculty not later than July 15th, and the fee named in Sec. VI, para. 10, received by the Chief Accountant not later than September 1st. Council reserves the right to reject applications of, or impose penalties upon, those failing to comply with these requirements. Arrangements will be made to conduct supplemental examinations at the Survey Camp for those students in attendance at the Camp.

2. If a candidate desires to write upon an annual examination as a supplemental, his application must be received by the Secretary and his fee by the Chief Accountant, for the January examinations not later than December 1st and for the April examinations not later than March 1st.

3. Except under very exceptional circumstances, pass standing must be obtained in all written supplementals before entering the next higher year, and in all laboratory supplementals before or during the Session of the next higher year as may be required by the Department concerned.

TERM EXAMINATIONS

Term examinations may be held in any subject and at any time at the discretion of the instructor, or by the order of the Council, and the results of such examination may, if the Council so decides, be incorporated with those of the annual examinations in the same subjects.

EX-SERVICE PERSONNEL

The foregoing regulations are applicable to all students of the Faculty. Special problems of students who have served in His Majesty's Armed Forces will be considered individually by the Council.

EXTRA-CURRICULAR ACTIVITIES AND ACADEMIC CREDIT

It is in general desirable for students to engage to a reasonable extent in extra-curricular activities in order that they may not become too narrowly professional in interests and outlook, but it will be obvious that no academic credit or consideration can be given for such activities. Some offices in student organizations require quite large amounts of time for the proper performance of the duties connected with them, and it is therefore strongly recommended that students, particularly those whose academic records are not high, consult a senior member of Staff before allowing themselves to be nominated for such offices.

SECTION XI. MEDALS, PRIZES, SCHOLARSHIPS, BURSARIES AND FELLOWSHIPS

Through the generosity of friends of the University, governments and commercial organizations, encouragement has been given to both undergraduate and graduate work in the various branches of engineering studies by establishing the following scholarships, prizes, bursaries, and medals.

Matriculation students are advised to consult the University of Toronto Calendar on Admission Requirements and Scholarships for complete details of awards available to students entering this Faculty.

Where it is necessary to make application for an award it is so stated in the description and particulars are given as to how the application should be made. In all other cases the award is made on the recommendation of the Faculty Council and no application is necessary.

In order to be eligible for a medal, prize, scholarship, bursary, fellow ship or other awards granted solely upon standing obtained at an annual or special examination or upon an essay, or term work, or other academic rating, a candidate must obtain honours at such annual or special examination or upon such essay, term work, or other academic rating unless the statute respecting the award or medal specifies that standing lower than honours may be accepted.

When an award or medal is granted upon standing obtained on part of the work of any academic year the candidate must obtain standing but need not obtain honours in the work of the academic year as a whole, provided he obtains honours in the part concerned, unless the statute respecting the award or medal specifies otherwise.

No medal, prize, scholarship, bursary, fellowship or other award will be granted to a candidate who is conditioned in any subject at an annual examination or in Physical Education unless the statute respecting the award or medal specifies otherwise.

A candidate will not be permitted to receive more than one award in a session unless the statute establishing each of the awards concerned or the Calendar specifies otherwise. Only one of those marked by an asterisk may be held in any one year. A candidate who would, but for this provision, have received more than one award may have his name so published in the class lists.

A candidate who has spent two sessions in any year of an undergraduate course is not eligible to compete for any award at the annual examinations of that year.

Medals, after they have been suitably engraved, will be given without delay to the winners or forwarded to them by registered mail.

Awards granted to members of graduating classes other than awards for graduate study and research, will be paid in one instalment as soon as possible after the granting of the awards.

All other awards will be paid (i) if of the value of $50 or less, in one instalment on November 20 and (ii) if of the value of more than $50 in two equal instalments, the first on November 20 and the second on February 20, in the session following the granting of the awards provided that no payment is made to a candidate (*a*) who is not in regular attendance upon lectures and laboratory classes in the Faculty, or if the Calendar so specifies, in the course in which the award is established or granted (*b*) who does not present at the Chief Accountant's Office before each payment a certificate of attendance upon lecture and laboratory classes signed by two senior members of the staff.

The Senate may, on the recommendation of the Faculty, permit a candidate to whom an award has been granted to postpone attendance upon lectures and laboratory classes for one year. Further postponement may be permitted on application.

Name	Amount	Application required	Available only to a limited group or single course	See page
AVAILABLE TO STUDENTS ENTERING THE FIRST YEAR				
Applied Science Bursaries.....	$2000	Yes	No	150
Emerson Wickett Memorial Scholarship...............	$100	Yes	No	150
Hagarty Memorial Scholarship	$60	Yes	Yes	150
U.T.S. Engineering Scholarship	$250	Yes	Yes	151
The Leonard Foundation Scholarships..............	—	Yes	Yes	151
The Robert Simpson Company Scholarship...............	$100	Yes	Yes	151
O.H.A. War Memorial Scholarship...............	$200	Yes	Yes	152
Engineering Alumni Admission Scholarship...............	$300	Yes	No	152
Students' Administrative Council Admission Scholarship...	$350	Yes	Yes	153
Ontario-Minnesota Pulp and Paper Co. Ltd. Bursaries...	$500	Yes	Yes	153
Algoma Ore Properties Limited Admission Scholarships.....	$4800	Yes	Yes	154

Name	Amount	Application required	Available only to a group or single course	See page
AVAILABLE TO STUDENTS COMPLETING THE FIRST YEAR				
University Alumni Federation War Memorial Scholarships.	$200	Yes	No	154
*Baptie Scholarship...........	—	No	Yes	154
MacLennan-MacLeod Memorial Prize..............	—	No	No	155
*Ransom Scholarship in Chemical Engineering............	$150	No	Yes	155
T. H. Bickle Prize...........	$30	No	Yes	155
*John M. Empey Scholarship..	$100	No	No	156
Garnet W. McKee-Lachlan Gilchrist Scholarship in Engineering Physics.......	$60	No	Yes	156
*Wallberg Undergraduate Scholarships..............	$600	No	No	156
*Association of Professional Engineers of the Prov. of Ontario Scholarships.......	$225	No	Yes	159
Hugh Gall Award...........	$100	Yes	No	156
University Naval Training Division Bursaries.........	$100	Yes	Yes	157
S. Ubukata Fund............	—	Yes	Yes	158
*Algoma Ore Properties Limited Undergraduate Scholarships.	—	No	Yes	157
University of Toronto General Bursaries.................	—	Yes	No	172
Dominion-Provincial Student-Bursaries.................	—	Yes	No	172
Scottish Rite Masons Bursary.	$100	Yes	Yes	157
AVAILABLE TO STUDENTS COMPLETING THE SECOND YEAR				
Rhodes Scholarship..........	£400	Yes	No	166
University Alumni Federation War Memorial Scholarships.	$200	Yes	No	154
*Harvey Aggett Memorial Scholarship...............	$75	No	No	158
J. A. Findlay Scholarship. ...	—	No	Yes	159

Name	Amount	Application required	Available only to a limited group or single course	See page
*Association of Professional Engineers of the Province of Ontario Scholarships.......	$175	No	Yes	159
T. H. Bickle Prize...........	$30	No	Yes	155
Women's Mining Association Scholarship...............	$300	Yes	Yes	160
*Garnet W. McKee-Lachlan Gilchrist Geophysics Scholarships...............	—	No	Yes	160
*John M. Empey Scholarship..	$100	No	No	156
W. G. Millar Memorial Scholarship...............	$250	Yes	Yes	156 161
*Wallberg Undergraduate Scholarships..............	$300	No	No	156
Ardagh Prize................	$50	No	Yes	161
*Algoma Ore Properties Limited Undergraduate Scholarships.	—	No	Yes	157
James L. Morris Memorial Prize	$60	No	Yes	161
University of Toronto General Bursaries.................	—	Yes	No	172
Dominion-Provincial Student-Aid Bursaries.............	—	Yes	No	172
Scottish Rite Masons Bursary.	$100	Yes	Yes	157
Eastern Steel Products Limited Scholarship...............	$350	Yes	Yes	162
AVAILABLE TO STUDENTS COMPLETING THE THIRD YEAR				
Rhodes Scholarship..........	£400	Yes	No	166
*Boiler Inspection and Insurance Company Scholarship......	$150	No	Yes	162
University Alumni Federation War Memorial Scholarships.	$250	Yes	No	154
*Jenkins Scholarship in Engineering...............	$200	No	No	162
Heating and Ventilating Engineers Prize................	$25	No	No	163
E.I.C. Prize.................	$25	No	Yes	163
Engineering Society Semi-Centennial Award..........	$75	No	No	163
J. A. Findlay Scholarship.....	—	No	Yes	159
*Association of Professional Engineers of the Province of Ontario Scholarships.......	$225	No	Yes	159

Name	Amount	Application required	Available only to a limited group or single course	See page
T. H. Bickle Prize	$30	No	Yes	155
Women's Mining Association Bursary	$150	Yes	Yes	160
Archie B. Crealock Memorial Prize	$25	No	Yes	163
*John M. Empey Scholarship	$100	No	No	156
Hudson Bay Mining and Smelting Company Limited Scholarships	$800	Yes	Yes	164
*Wallberg Undergraduate Scholarships	$300	No	No	156
*Algoma Ore Properties Limited Undergraduate Scholarships.	—	No	Yes	157
Chemical Institute of Canada Prize	$25	No	Yes	164
Kennecott Copper Corporation Scholarship	$750	No	Yes	164
University of Toronto General Bursaries	—	Yes	No	172
Dominion-Provincial Student-Aid Bursaries	—	Yes	No	172
Scottish Rite Masons Bursary.	$100	Yes	Yes	157
AVAILABLE TO STUDENTS COMPLETING THE FOURTH YEAR				
B.A.A.S. Medal		No	No	164
Heating and Ventilating Engineers Prize	$25	No	No	163
INCO. Scholarship	$500	Yes	Yes	164
"Second Mile Engineer" Award	$100	No	Yes	165
Henry G. Acres Medal	—	No	Yes	165
University of Toronto General Bursaries	—	Yes	No	172
Dominion-Provincial Student-Aid Bursaries	—	Yes	No	172
AVAILABLE TO GRADUATES				
Rhodes Scholarship	£400	Yes	No	166
1851 Exhibition Science Research Scholarships	£275	Yes	Yes	167

Name	Amount	Application required	Available only to a limited group or single course	See page
McCharles Prize	$1000	No	No	168
Nipissing Mining Research Fellowships	$1100	Yes	No	168
H. W. Price Research Fellowship in Electrical Engineering	—	Yes	Yes	168
C.I.L. Fellowship in Chemistry	$750	Yes	Yes	169
T. A. Russell Memorial Research Fellowship	$1000	Yes	Yes	169
Consolidated Mining and Smelting Company Fellowship	$750	Yes	No	169
Canadian Institute of Steel Construction Research Fellowship	$1200	Yes	No	169
Canadian Lumbermen's Association Timber Research Fellowship	$1000	Yes	No	170
Imperial Oil Graduate Research Fellowships	$4000	Yes	Yes	170
Wallberg Research Fellowships	$3000	Yes	No	170
Spruce Falls Power and Paper Company Limited Fellowships	$750	Yes	No	170
Algoma Ore Properties Limited Graduate Fellowships	$2200	Yes	Yes	171
1940 Toronto Fund	—	Yes	No	171
Raymond Priestley Fellowship	£450	Yes	No	171
Royal Institution of Great Britain Science Research Scholarships	£350	Yes	No	172

NOTE—On account of the continued tendency towards lower rates of interest it is possible that the value of certain scholarships or prizes at the time of payment may prove to be less than the amount stated in the calendar.

APPLIED SCIENCE BURSARIES

To assist promising students in the secondary schools who would otherwise be prevented for financial reasons from entering the Faculty of Applied Science, the Board of Governors has allocated $2000 to assist such persons to commence work at the University. A number of Bursaries, each amounting to approximately $200, will be awarded in 1949 to those applicants who are considered by the Council of the Faculty to be most eligible. An applicant must have obtained First Class Honours in Mathematics and a high proficiency record in the remaining subjects at the Grade XIII examinations for the Province of Ontario, or their equivalent.

Each applicant must apply by letter, giving full particulars of his case, to the Secretary of the Faculty of Applied Science and Engineering not later than September 1, 1949. This application must be accompanied by a letter of recommendation from the principal of the secondary school where his standing was obtained, and if possible a second letter of recommendation from a graduate in engineering, preferably of the University of Toronto, who resides or practises in the vicinity. Application for admission to the University, accompanied by matriculation certificates, must also be submitted to the Registrar of the University at the same time that application for the Bursary is submitted to the Secretary of the Faculty. Some members of the engineering profession have agreed to act as counsellors to prospective students, and the name of one or more of these men residing in the neighbourhood of the applicant may be obtained on application to the Secretary of the Faculty.

THE EMERSON WICKETT MEMORIAL SCHOLARSHIP

The Emerson Wickett Memorial Scholarship, the gift of Mrs. Maude Wickett Kilbourn, in memory of her brother, the late William Emerson Wickett, a graduate of the Faculty of Applied Science and Engineering in 1906, of the value of $100, is awarded to the candidate who, at one examination, obtains standing with the highest average percentage in the subjects of Grade XIII prescribed for admission to the Faculty. An award will not be made in any year in which no candidate obtains an average of at least seventy-five per cent. Application should be made to the Registrar of the University.

THE REGINALD AND GALER HAGARTY SCHOLARSHIP

The Reginald and Galer Hagarty Scholarship, in memory of the dearly beloved sons of Lieutenant-Colonel E. W. Hagarty, B.A. 1883, M.A. 1908, and Charlotte Ellen Hagarty, his wife. Reginald Edward Walter Hagarty, B.A.Sc. (Honours) 1908, a graduate of the University in the Faculty of Applied Science and Engineering and at the time of his death on April 29, 1925, a Consulting Structural Engineer. Lieutenant Daniel Galer Hagarty, Princess Patricia's Canadian Light Infantry, a member of the class of 1916 in Applied Science, enlisted for the Great War at the end of his third year in June, 1915, killed in action in Sanctuary Wood, June 2, 1916. The scholarship is given in recognition of the fact that their father was an

honour graduate in Classics of the University of Toronto. It is of the value of the interest on $2,000 and is to be awarded to a pupil of Harbord Collegiate Institute, Toronto, who at the Grade XIII examinations in the subjects of English, French, Latin and Mathematics stands highest among the students of that school who (*a*) register in the Faculty of Applied Science and Engineering, (*b*) sign a declaration to the effect that they are willing to take up arms in defence of Canada and the British Empire should necessity arise as declared by the Parliament of Canada and (*c*) obtain at least a pass mark in each of the said subjects. The scholarship was offered for award for the first time in 1945. Application should be made to the Registrar of the University.

THE U.T.S. ENGINEERING SCHOLARSHIP

The U.T.S. Engineering Scholarship, the gift of R. A. Bryce, Esq., of the value of $250. The scholarship will be awarded by a committee of the Staff of the University of Toronto Schools to a student of the Schools who has completed the requirements for admission to and enrols in the Faculty of Applied Science and Engineering.

THE LEONARD FOUNDATION SCHOLARSHIPS

Leonard Foundation Scholarships are awarded each year to selected students in Universities and Colleges across Canada, including the University of Toronto. The Trust Deed States: "Preference in the selection of students for scholarships shall be given to the sons and daughters respectively of the following classes: (*a*) clergymen, (*b*) school teachers, (*c*) officers, non-commissioned officers and men, whether active or retired, who have served in His Majesty's military, naval or air forces, (*d*) graduates of the Royal Military College of Canada, (*e*) members of the Engineering Institute of Canada, (*f*) members of the Mining and Metallurgical Institute of Canada."

All applicants must be nominated by a member of the General Committee. The latest date for the receiving of applications is March 31st, for the following academic year. Further information regarding the procedure to be followed in applying for these scholarships may be obtained by writing to Dr. W. E. Taylor, Honorary Secretary, The Leonard Foundation, c/o Toronto General Trusts Corporation, 253 Bay Street, Toronto.

THE ROBERT SIMPSON COMPANY LIMITED SCHOLARSHIPS

These scholarships, the gift of the Robert Simpson Company Limited, are open only to students of the Copper Cliff High School, The Sudbury High and Technical Schools, the Sturgeon Falls High School, the North Bay Collegiate Institute and Vocational School, the Kapuskasing High School and all the Secondary Schools along the Ontario Northland Railway. A scholarship of the valueof $100 is available for each of the schools mentioned and an additional sum of $50 will be given to the student who obtains the highest percentage on the nine papers of Grade XIII selected in accordance with the regulations.

No scholarship will be awarded unless the candidate is in actual attendance in one of the colleges or faculties of the University and maintains a uniformly high standard to the satisfaction of the donors of the scholarships.

Applications for these scholarships must be sent not later than May 15th, to the Principal of the North Bay Collegiate Institute and Vocational School, from whom further information may be obtained regarding conditions of award.

THE ONTARIO HOCKEY ASSOCIATION WAR MEMORIAL SCHOLARSHIP

The Ontario Hockey Association War Memorial Scholarship, the gift of the Ontario Hockey Association, is to be awarded annually at the Grade XIII examination to a man student who has served overseas with the Canadian forces in the Great War of 1914-1918, or to a student who is the son or daughter of one who has so served.

The value of this scholarship is $100 in cash, with an allowance of the same amount on the tuition fee for each session.

In determining the award of the scholarship, the academic qualifications of the candidate shall be first taken into account, provided always that no candidate shall be eligible for an award who has not met all the conditions required by the University of candidates for admission scholarships generally; but, *cæteris paribus*, the award shall be made to a student who is in proved need of assistance.

The award shall be made by the Senate of the University upon the report of a committee to be appointed by the Senate, upon which committee there shall be always one member of the Staff of the University who shall be deemed to be the representative of the Association.

Candidate shall make application not later than May 1st on the special form to be obtained from the Registrar of the University.

ENGINEERING ALUMNI ADMISSION SCHOLARSHIP

The Engineering Alumni Admission Scholarship, the gift of the Engineering Alumni Association, of the value of $300, is awarded on the recommendation of the Council of the Faculty to the candidate who obtains the highest average percentage in the subjects of Grade XIII prescribed for admission to the Faculty of Applied Science and Engineering; applicants are required to write the Problems paper for Scholarship candidates, but the standing on this paper will be used only as auxiliary information. In order to qualify for the scholarship a candidate must at one Scholarship examination obtain an average of at least seventy-five per cent. in the subjects of Grade XIII prescribed for admission to the Faculty and must register in the Faculty of Applied Science and Engineering. The scholarship will not be awarded to a student who has spent more than one year in Grade XIII or more than five years in a Secondary School or its equivalent unless he can show evidence satisfactory to the

Council that his attendance has been extended beyond the period specified for reasons beyond his control. This scholarship is not tenable with any other Admission scholarship.

STUDENTS' ADMINISTRATIVE COUNCIL ADMISSION SCHOLARSHIP

The Students' Administrative Council Admission Scholarship of the annual value of $300, the gift to a student who (*a*) resides within the District of Manitoulin, or within that part of the Province of Ontario which lies north of the forty-sixth parallel of latitude excluding the cities of North Bay, Sudbury, Sault Ste. Marie, Port Arthur and Fort William; (*b*) obtains the highest average standing in first class honours in the nine papers of Grade XIII prescribed for admission to the course which he desires to enter: and (*c*) who enrols in one of the following faculties: Medicine, Applied Science and Engineering, Forestry, Dentistry, in the School of Architecture, or in the Four-Year Course leading to the degree of Bachelor of Science in Pharmacy.

The scholarship is tenable for two years provided that the holder obtains an average of at least sixty-six per cent. at the annual examinations of the First Year. Application must be made to the University Registrar not later than May 1st.

ONTARIO-MINNESOTA PULP AND PAPER COMPANY LIMITED BURSARIES

The Ontario-Minnesota Pulp and Paper Company Limited Bursaries, awarded at the discretion of the donors, two in number, each of the value of $500 a year for four years for students who enrol in the Faculty of Arts in the honour courses of Chemistry, Physics and Chemistry (Chemistry option) or Commerce and Finance, or in the Faculties of Applied Science and Engineering or Forestry. They will be awarded one to a student who has completed the University admission requirements at Kenora High School after at least two years' attendance at that school, and the other to a student who has completed the University admission requirements at Fort Frances High School after at least two years' attendance at that school. The decision of the Committee of Award which consists of the President and the Deans of the Faculties of Arts, Applied Science and Engineering, and Forestry will be based primarily on the marks obtained at the Grade XIII examination, but consideration will be given also to physical fitness and financial requirements. In order to retain a bursary from session to session the student to whom one is awarded must, in the opinion of the Committee of Award have a satisfactory record as regards the general character of his work throughout the session, including attendance, laboratory and field work, if any, reports or essays, and term examinations, and must obtain standing in his year. His behaviour while attending the University must be above criticism. Application must be made to the Registrar not later than May 1st.

ALGOMA ORE PROPERTIES LIMITED ADMISSION SCHOLARSHIPS

Algoma Ore Properties Limited, Sault Ste Marie, Ontario, provided funds for one Admission Scholarship for the Session 1947-48, three for the Session 1948-49 and two for the Session 1949-50, each of a value of $800.00 They were open only to students entering Mining Engineering, Metallurgical Engineering, and Mining Geology, and awarded to applicants obtaining the highest average percentage in the subjects of Grade XIII prescribed for admission to the Faculty of Applied Science and Engineering.

Provision is made for the winner of the Scholarship in 1947 to hold a Scholarship in his Second Year, and succeeding years of a value of $600.00 annually, provided he obtains Honours each year. Provision is also made for scholarships in the Second Year and succeeding years of a value of $600.00 each, to be awarded to the two students who obtain the highest honour standing of those who are awarded the admission scholarships in 1948 and 1949.

ALUMNI FEDERATION WAR MEMORIAL SCHOLARSHIPS AND AWARDS

Eight scholarships and awards, each of the value of $200.00 will be granted in 1949-50 by the Alumni Federation from the War Memorial Scholarship Fund to students registered in the Faculty of Applied Science and Engineering.

The general basis on which scholarships or awards may be granted shall be as follows: (*a*) standing in course of studies; (*b*) relationship to active service in the armed forces of Canada; (*c*) need of fin ncial assistance; (*d*) merit shown by participation and interest in extra-curricular undergraduate activities of the University; (*e*) such other general qualifications as may commend themselves to the committee recommending the awards.

Information regarding these scholarships and awards may be obtained from the Secretary of the Alumni Federation, 42 St. George Street, to whom application for the same must be made in person before April 15th.

BAPTIE SCHOLARSHIP

The Baptie Scholarship is derived from a bequest under the will of the late Mrs. Margaret W. Baptie, of Ottawa, and the Board of Governors has directed that from the income a scholarship shall be awarded annually to an engineering student on the record of the First Year. The Board of Governors also authorizes a remission of fees in the case of the holder of the scholarship, up to Seventy-five Dollars.

The conditions of the award are as follows: That the scholarship be awarded to the student who, in the annual examinations of the First Year, enrolled in any one of the courses of Civil Engineering, Mining Engineering, Mechanical Engineering, Chemica Engineering, Electrical Engineering, or Metallurgical Engineering, obtains the highest aggregate percentage of marks in those subjects which are common to the First Year curricula of those courses. The first award was made on the results of the annual examinations of the Session 1925-26.

MACLENNAN-MACLEOD MEMORIAL PRIZE

The Graduating Class of 1910 has donated an annual prize, known as "The MacLennan-MacLeod Memorial Prize", in memory of their first Class President, George MacLennan, who was killed in action in France in 1917, and of Doug. MacLeod, their first Secretary, who died in France in 1916 from wounds received in action.

The prize is awarded to the First Year student in the Faculty of Applied Science and Engineering who ranks highest in Calculus among those who obtain standing without condition at the annual written examinations; or, in the event of more than one student obtaining equally high rank in Calculus, the award is made to the one of these who also has the highest standing in some other subject common to the competitors, such as Analytical Geometry, such subject to be determined by the Council of the Faculty.

An award will not be made in any year in which, in the opinion of the Council, no student obtains a sufficiently high standing in Calculus to merit the award. In any year in which no award is made, the income from the prize of that year will be available for a second award in any subsequent year.

RANSOM SCHOLARSHIP IN CHEMICAL ENGINEERING

The Ransom Scholarship in Chemical Engineering is presented by A. C. Ransom, Esq., of Toronto, for the purpose of encouraging and giving financial assistance to students who choose the field of Chemical Engineering. This donation, consisting of $5,000, provides for a perpetual scholarship of an annual amount such as will be derived from the income of this sum. The first award was made on the results of the annual examinations of 1938.

The scholarship will be awarded annually to the student registered in the Course in Chemical Engineering who obtains the highest aggregate percentage of marks in the examinations of the First Year. The scholarship will be paid to the winner only if he proceeds to take his Second Year in the Course in Chemical Engineering in the University of Toronto.

THE T. H. BICKLE PRIZE

The T. H. Bickle Prize is the gift of Mr. and Mrs. E. W. Bickle in memory of their son, T. H. Bickle, an undergraduate of Trinity College and a member of the Senior Intercollegiate Swimming Team at the time of his death in 1937. The income from the endowment fund will be used to purchase a suitable prize to be awarded annually to a member of the Senior Intercollegiate Swimming Team of this University in any year, faculty or school. The Committee of Award shall consist of the Dean of the Faculty of Arts, the University Registrar, the Director of Athletics, and the Honorary Coach of Swimming. In awarding the Prize the Committee shall consider the character, scholarship, and general interests of the members of the team.

THE JOHN M. EMPEY SCHOLARSHIPS

The John M. Empey Scholarship Fund was established under a bequest of $10,000 in the Will of the late John Morgan Empey, B.A.Sc., 1903. Three scholarships of equal value are provided from the income from the Fund. One of these scholarships is awarded in each of the First, Second, and Third Years on the results of the annual examinations, to a student who, taking honours, obtains the highest average percentage of marks in the written and laboratory subjects of his Year. The scholarships are open to any students registered in the Faculty. In case the winner of any one of these scholarships does not attend this Faculty during the session next following the award, the right to the scholarship shall be forfeited and the award shall be made to another eligible student. The scholarships were awarded for the first time in 1944.

THE GARNET W. MCKEE-LACHLAN GILCHRIST SCHOLARSHIP IN ENGINEERING PHYSICS

Mrs. Garnet W. McKee and Professor Lachlan Gilchrist each contributed $1000.00 to provide for a Scholarship in the First Year of the Course in Engineering Physics. The value of the Scholarship is the annual income from the capital fund and is awarded to the student who ranks first in honours at the annual examinations of the First Year in the Course in Engineering Physics. If for any reason that student is ineligible to hold the Scholarship, it will be awarded by reversion to the student ranking second in honours in the Course. In order to receive payment the winner must register in the Second Year of the Course in Engineering Physics. The Scholarship was awarded for the first time on the results of the annual examinations of 1947.

WALLBERG UNDERGRADUATE SCHOLARSHIPS

These scholarships, four in number, of the value of $300.00 each, derived from the Wallberg Bequest, are awarded annually; two to students ranking first and second respectively at the annual examinations of the First Year; one to the student ranking first at the annual examinations of the Second Year; and one to the student ranking first at the annual examinations of the Third Year.

Any holder of one of these scholarships may not hold other awards listed in the Calendar with an asterisk. The awards were first made on the result of the annual examination of 1947.

HUGH GALL AWARD

The Hugh Gall Award, of the value of One Hundred Dollars, the gift of the Graduate Class of 1910, "to commemorate a deceased classmate who was a splendid type of student, a loyal friend, and nationally outstanding in athletic achievement during his undergraduate career", was established in 1946. It is awarded to a student, who, having completed his First Year with a general average of at least 66% without conditions,

has entered the Second Year, and is in special need of financial assistance in order to enable him to continue his course. It is desirable, but not necessary, that the recipient shall not already have been given any other scholastic award or scholarship applicable to the Second Year and he shall have shown indications of his firm intention and ability to follow successfully the profession of engineering.

Any second year student in the Faculty of Applied Science and Engineering is eligible to apply for this Bursary. Applications should be made to the Secretary of the Faculty not later than one month after the opening of the session.

UNIVERSITY NAVAL TRAINING DIVISION BURSARIES

The University Naval Training Division Bursaries, the gift of the University Naval Training Division, are of the value of $100. each. As many as three bursaries may be awarded in each session; if fewer than three are awarded those not awarded may be given in a subsequent session. A candidate must be registered in the University for a full-time course leading to a diploma or degree and must be at the time of the award a member of one of the recognized military training units within the University. Application must be made to the University Registrar before the end of November.

THE SCOTTISH RITE MASONS' BURSARY

The Scottish Rite Masons' Bursary, the gift of the Scottish Rite Masons of Toronto, of the value of $100. is awarded to a student enrolled in the Second Year who is a member of the Masonic Order, or a son, brother, nephew, daughter, sister or niece of a member of the Masonic Order. Consideration will be given to financial need and academic standing. Evidence of connection with the Masonic Order and information regarding financial need must be given with the application which must be submitted to the Secretary of the Faculty.

ALGOMA ORE PROPERTIES LIMITED UNDERGRADUATE SCHOLARSHIPS

Through the generosity of Algoma Ore Properties Limited, Sault Ste. Marie, Ontario, a number of Scholarships are available to students in Mining Engineering, Metallurgical Engineering, and Mining Geology, each of a value of $600.00. On the results of the annual examinations for the Sessions indicated below, the following scholarships will be awarded:

Session 1947-48

I Year—One Scholarship of Six Hundred Dollars.
II Year—Three Scholarships of Six Hundred Dollars.
III Year—Three Scholarships of Six Hundred Dollars.

Session 1948-49

I Year—One Scholarships of Six Hundred Dollars.
II Year—One Scholarship of Six Hundred Dollars.
III Year—Three Scholarships of Six Hundred Dollars.

Session 1949-50

I Year—One Scholarship of Six Hundred Dollars.
II Year—One Scholarship of Six Hundred Dollars.
III Year—One Scholarship of Six Hundred Dollars.

Session 1950-51

II Year—One Scholarship of Six Hundred Dollars.
III Year—One Scholarship of Six Hundred Dollars.

Session 1951-52

III Year—One Scholarships of Six Hundred Dollars.

On the examination results of 1947-48 the First Year Scholarship was awarded to the winner of the Algoma Ore Properties Limited Admission Scholarship of September, 1947. The Second and Third Year Scholarships were awarded to those obtaining highest Honour standing in Mining Engineering, Metallurgical Engineering, and Mining Geology.

On the examination results for First Year for 1948-49 and 1949-50, two scholarships, one in each session, will be awarded to the students who stand highest of those who were awarded Algoma Ore Properties Admission Scholarships in September, 1948, and 1949.

It is the intention that a student having once won a scholarship on the results of the Annual Examinations should continue to hold it, provided he obtains Honours in his work in subsequent years.

The holders of any of these scholarships may not hold other scholarships in the same session.

S. UBUKATA FUND

The S. Ubukata Fund for Japanese Students, the gift of the late S. Ubukata, provides for the establishment of scholarships, bursaries, medals, prizes, and loans for students from Japan proper attending the University of Toronto or one of its federated or affiliated colleges. An applicant for a scholarship, bursary or loan must be in good standing and have completed the first year of the work of the faculty or department in which he is registered. An occasional student must obtain a certificate from the head of the college or dean of the faculty concerned that full time is being devoted to his or her studies. A student is not eligible who is at the time in receipt of aid or support from any other institution, religious or otherwise, in this country or in Japan or who already holds a scholarship or fellowship in the University. Application must be made to the University Registrar on or before December 1st.

HARVEY AGGETT MEMORIAL SCHOLARSHIP

This scholarship was donated by the late Mr. J. T. Aggett, of Toronto, as a perpetual memorial to his son, the late Lieutenant Harvey Aggett, who enlisted in March, 1915, during his second year in this Faculty, and was killed in action at Passchendaele on 6th November, 1917.

This annual scholarship of the value of the annual income from the fund is to be awarded to a student of the Second Year in this Faculty who, obtaining honours and being one of the first three in his year by his standing at the annual examinations, has been adjudged highest of the three in general student activities and service in the University during his period of attendance. When regulations do not permit the winner to hold this scholarship the students to be considered for the award shall be the first three in the year exclusive of any student who holds a scholarship of higher value.

J. A. FINDLAY SCHOLARSHIPS

These scholarships were established through a legacy bequeathed by the late Miss Janet Findlay to the Department of Mechanical Engineering. Two scholarships are available to students in this Course, one for a student in the Third Year, the other for a student in the Fourth Year, but only if the student continues his course in Mechanical Engineering. The selection will be made, on recommendation of the Head of the Department of Mechanical Engineering, from amongst the four students having the highest average percentage of marks at the annual examinations in the Second and Third Years respectively, but in making the award the student's general character, fitness for his profession, and financial circumstances will be given consideration. In case a student who has been awarded one of the scholarships changes his course or does not attend this University during the next following session, he shall forfeit his right to the scholarship and the award shall be made to another eligible student.

ASSOCIATION OF PROFESSIONAL ENGINEERS OF THE PROVINCE OF ONTARIO SCHOLARSHIPS

The Association of Professional Engineers of the Province of Ontario offers the following scholarships to students registered in any course of the Faculty of Applied Science and Engineering:—

(*a*) Scholarships of One Hundred Dollars, Seventy-five Dollars and Fifty Dollars, respectively, to the three students in the First Year who, taking honours, obtain the highest percent of the total number of marks in their respective courses.

(*b*) Scholarships of One Hundred Dollars and Seventy-five Dollars, respectively, to the two students in the Second Year who, taking honours; obtain the highest per cent of the total number of marks allotted to the subjects of their respective courses.

(*c*) Scholarships of One Hundred Dollars, Seventy-five Dollars and Fifty Dollars, respectively, to the three students in the Third Year who, taking honours, obtain the highest per cent of the total number of marks in their respective courses.

These scholarships will not be awarded to students who hold other scholarships.

THE WOMEN'S MINING ASSOCIATION BURSARY

The Women's Mining Association has presented a Bursary having the value of Three Hundred Dollars annually, commencing 1939. The Bursary is awarded to a student entering the Third or Fourth Year in the Course in Mining Engineering, Metallurgical Engineering, or Mining Geology; it may be awarded two years in succession to the same student, but will usually be awarded at the beginning of the Third Year. The award will be made by a special committee appointed by the Association on the following basis:

(*a*) In addition to mental capacity, the student must show leadership ability and give promise, through his activities, of becoming a worthwhile influence in the affairs of the profession and the community.

(*b*) While attention is given to scholastic ability, as evidenced by his academic standing, it is not the governing factor. He must, however, stand in the top quarter of his class.

(*c*) Special consideration is given to financial need.

Application must be made to the Secretary of the Faculty within one month of the opening of the academic year.

THE GARNET W. MCKEE-LACHLAN GILCHRIST GEOPHYSICS SCHOLARSHIPS

Financial assistance was received by Professor Lachlan Gilchrist of the Department of Physics, University of Toronto, from certain organizations and individuals to help him in the prosecution of his research work in Geophysics. With the consent of the contributors, the unexpended balance of these gifts was transferred by Professor Gilchrist to the Board of Governors of the University to be used as an endownment for scholarships, two of which were established in the Faculty of Applied Science and Engineering. To this fund have been added additional amounts received from the estate of the late Garnet W. McKee and from the Hollinger Consolidated Gold Mines Ltd. They are awarded by the Senate, on the recommendation of the Council of the Faculty of Applied Science and Engineering. The first awards were made on the results of the Annual Examinations of 1941.

The First Garnet W. McKee-Lachlan Gilchrist Geophysics Scholarship.

This scholarship, of the annual value of the income from $4,000.00, is awarded to the student in the Second Year in the Course of Engineering Physics who obtains the highest aggregate standing at the examinations of the First and Second Years in the Course, provided always that the student obtains honour standing at the examinations of the Second Year.

The Second Garnet W. McKee-Lachlan Gilchrist Geophysics Scholarship.

This scholarship, of the annual value of the income from $3,000.00 is awarded to the student in the Second Year in the Course in Engineering Physics who, of those students who elect to proceed in the Third Year in

the Geophysics Option of the Course, obtains the highest aggregate standing at the examinations of the First and Second Years, provided always that the student obtains honour standing at the examinations of the Second Year, and excluding always the student to whom the First Lachlan Gilchrist Geophysics Scholarship has been awarded.

If in any year there is no student who has fulfilled the conditions as laid down for the Second Lachlan Gilchrist Geophysics Scholarship, it shall be awarded to the student in the Second Year in the Course in Engineering Physics who obtains the second highest aggregate standing at the examinations of the First and Second Years of that Course, provided always that such student obtains honour standing in the examinations of the Second Year.

THE W. G. MILLAR MEMORIAL SCHOLARSHIP

The W. G. Millar Memorial Scholarship is presented by Irish and Maulson, Limited, of an annual value of $250.00, in memory of the late Mr. W. G. Millar, a member of the Class of 1914 in Civil Engineering. The Scholarship will be awarded to a student entering the Third Year in Mining Engineering, on the recommendation of the Head of the Department of Mining Engineering.

The award will be made on the following basis:

(*a*) In addition to mental capacity, the student must show leadership ability and give promise, through his activities, of becoming a worthwhile influence in the affairs of the profession and the community.

(*b*) While attention is given to scholastic ability, as evidenced by his academic standing, it is not the governing factor. He must, however, stand in the top quarter of his class.

(*c*) Special consideration is given to financial need.

Application must be made to the Secretary of the Faculty within one month of the opening of the academic year.

ARDAGH PRIZE

The Ardagh Prize, of the annual value of Fifty Dollars, has been provided in memory of his parents by Professor E. G. R. Ardagh, B.A.Sc., F.R.S.C., formerly professor of Applied Chemistry in the Faculty. It is awarded to the student who attains the highest standing in Honours at the annual examinations of the Second Year in the Course in Chemical Engineering. The first award was made on the results of the annual examination of 1946.

Provision has been made for annual increases to the fund from which the prize is derived until the sum of Five Thousand Dollars is reached in 1956, at which time the award becomes the Ardagh Scholarship of the value of the income from the said fund.

JAMES L. MORRIS MEMORIAL PRIZE

The James L. Morris Memorial Prize is the gift of Mrs. J. H. Craig and Mr. J. R. Morris, K.C., in memory of their father, James L. Morris,

C.E., O.L.S., D.Eng., the first graduate of the School of Practical Science, who died in 1946 after a distinguished career. Graduating in Civil Engineering in 1881 as the sole member of his class, Dr. Morris engaged in railway work for some time, first as an engineer and then as a contractor. For 43 years he conducted a successful civil engineering practice in Pembroke, Ontario, involving important undertakings in the field of municipal, power and bridge work.

This Prize, of the value of the annual income frcm $2,000.00, is awarded annually to the student in the Second Year in the Course in Civil Engineering who obtains the highest aggregate percentage at the annual examinations of the First and Second Years of the course, provided always that the student obtains honour standing at the Examinations of the Second Year.

EASTERN STEEL PRODUCTS LIMITED SCHOLARSHIP

The Eastern Steel Products Limited Scholarship of an annual value of $350.00 has been established in the course in Mechanical Engineering for a period of five years.

The Scholarship will be awarded to a student entering the Third Year in Mechanical Engineering who:

(*a*) was registered in the course in Mechanical Engineering in this Faculty in his First and Second Years.

(*b*) obtained Honours in the work of the First and also of the Second Year.

(*c*) gives evidence not only of mental capacity but who also shows leadership ability, and gives promise of becoming a worth while influence in affairs of the profession and the community.

Consideration is given to financial need.

Application must be made to the Secretary of the Faculty not later than March 15.

The first award was made at the Annual Examinations of 1948.

BOILER INSPECTION AND INSURANCE COMPANY SCHOLARSHIP

The Boiler Inspection and Insurance Company of Canada offers a scholarship in the Course in Mechanical Engineering of the value of One Hundred and Fifty Dollars to the student who obtains highest honour standing in the regular examinations of the Third Year.

The successful candidate will be expected to proceed to his Fourth Year during the session next following the date of the award.

The amount of the award will be credited by the Bursar to the fees of the Fourth Year of the successful candidate.

JENKINS SCHOLARSHIP

The Jenkins Scholarship, presented by Jenkins Bros., Limited, Montreal, first awarded in 1925, has been donated to continue indefinitely.

This Annual Scholarship, of the value of Two Hundred Dollars, is awarded to the student of the Third Year registered in any course of the Faculty who has the highest aggregate of percentages for the First, Second, and Third Years.

HEATING AND VENTILATING ENGINEERS PRIZE

The Ontario Chapter of the American Society of Heating and Ventilating Engineers offers an annual prize of Twenty-five Dollars, first awarded in 1931, for a period of five years, and extended indefinitely in 1935. The prize will be awarded to a student in either the Third or Fourth Year in any Course of the Faculty who, in the opinion of the Department of Mechanical Engineering, has written the most satisfactory thesis on a subject dealing with heating or ventilation, such thesis being prepared under special arrangements made by the Department of Mechanical Engineering, the result to be reported to the Council with the annual examination results. The thesis must be handed in not later than March 1st. The prize will not necessarily be awarded in any year.

Application should be made to the Department of Mechanical Engineering.

ENGINEERING INSTITUTE OF CANADA PRIZE

The Engineering Institute of Canada, having in view that one of its objects is to facilitate the acquirement and interchange of professional knowledge among its members, offers an annual prize of Twenty-five Dollars in this University, commencing 1931, to the student who, in his Third Year in any one of the six courses of Engineering, has proved himself most deserving as disclosed by the examination results of the year, in combination with his activities in the Engineering Society or with a local branch of another recognized engineering organization.

ENGINEERING SOCIETY SEMI-CENTENNIAL AWARD

The Engineering Society Semi-Centennial Award, to the value of Seventy-five Dollars, was established in 1931 to commemorate the semi-centennial of the founding of the "School". The award is made to a student entering the final year.

The selection is based upon the following qualifications, which bear equal weight in the selection of the winner: (*a*) General "School" activities. (*b*) Contributions to the Engineering Society Executive Committee. (*c*) Personality, and social and athletic activities. (*d*) Academic standing.

ARCHIE B. CREALOCK MEMORIAL PRIZE

The Archie B. Crealock Memorial Prize is the gift of Mrs. Archie B. Crealock, in memory of her husband, an eminent bridge engineer and a graduate of the Faculty of Applied Science and Engineering of the University of Toronto. It is offered annually to the student of the Third Year in the Course in Civil Engineering, who, having obtained honoures in that year, is deemed to be the most worthy of the award. The award is

made primarily on the basis of academic standing in the structural subjects of the Year, but extra-curricular activities are also taken into consideration. The Prize consists of engineering books to the value of Twenty-five Dollars. The award will not necessarily be made in any year.

HUDSON BAY MINING AND SMELTING COMPANY LIMITED SCHOLARSHIPS

The Hudson Bay Mining and Smelting Company Limited awards Scholarships to students who have obtained their Senior Matriculation at the High Schools in Flin Flon, Manitoba, and its environs. These Scholarships, having a value of $800.00 each annually, may be held in the Third and Fourth Years in this Faculty, in the Course in Chemical Engineering, Metallurgical Engineering, Mining Engineering, and Mining Geology. Application should be made to the Company.

CHEMICAL INSTITUTE OF CANADA PRIZE

The Chemical Institute of Canada offers a prize of the annual value of $25.00 in books to the student registered in the course in Chemical Engineering who, having obtained honours, receives the highest standing in the written and laboratory work of the Third Year.

The first award was made on the results of the final examinations of 1947.

KENNECOTT COPPER CORPORATION SCHOLARSHIP

The Kennecott Copper Corporation offers a scholarship of a value of $750.00 annually to a student who has completed three years of the course in Mining Engineering or, in an exceptional case, to a graduate student proceeding to the Degree of Master of Applied Science in Mining Engineering. The award will be made on the following basis.

(*a*) proficiency in engineering studies.
(*b*) leadership, willingness, co-operativeness, initiative and ambition.
(*c*) ability to direct and stimulate others and to command their respect.
(*d*) good health and physique.

The first award was available in 1948.

B.A.A.S. MEDAL

A bronze medal has been donated by members of the British Association for the Advancement of Science, for students of the Faculty of Applied Science and Engineering. This medal will be awarded to the student of the Final Year, in any course, who, taking honours, obtains the highest aggregate percentage in practical and written examinations in the Year.

INCO SCHOLARSHIP

The International Nickel Company of Canada, Limited, offers a scholarship of $500.00, commencing with the Session 1941-42, and from year to year thereafter as the Company may decide, to be awarded to a graduate of the Faculty of Applied Science and Engineering in Chemical

Engineering, Metallurgy Engineering, Mining Engineering or Mining Geology, who has taken a consistently high standing in the majority of the subjects of his course, and who is adjudged by the Council of the Faculty to be most suitable to receive the award.

The applicant must proceed to the M.A.Sc. degree in the Session in which he receives the scholarship. Application must be made before May 1, to the Secretary of the School of Graduate Studies, with a statement of the research problem which he proposes to study.

"SECOND MILE ENGINEER" AWARD

Inspired by an address of President William E. Wickenden of Case School of Applied Science, Cleveland, called "The Second Mile", which was based on the text from the Sermon on the Mount, "whosoever shall compel thee to go one mile, go with him twain", the Class of 1935 has established the "Second Mile Engineer" Award. It is the desire of the donors to encourage students to participate in activities outside the confines of their technical training and to interest themselves in the more liberal subjects of the curriculum. The value of the award is $100.00 and is given to a student in his final year.

An eligible group is chosen from those who have taken a prominent part in the affairs of the Faculty, either as office holders or in athletics. In making the award consideration is given to academic standing, with special enphasis on the candidate's attainments in the cultural and humanistic-social studies. The subjects which are stressed are English, and Engineering and Society of the First Year; Economics of the Second Year; and Political Science, and Modern World History of the Third Year.

Particulars are furnished each session by the Class of 1935.

HENRY G. ACRES MEDAL

The Henry G. Acres Medal is the gift of Mrs. Henry G. Acres in memory of her late husband, Henry G. Acres, M.E., D.Sc., a graduate of the School of Practical Science in the class of 1903. Throughout his professional life Dr. Acres was associated with major power developments in Canada and abroad. As chief hydraulic engineer for the Hydro-Electric Power Commission of Ontario in the period 1911 to 1923, he was responsible for the design and construction of nearly twenty power plants, including the Queenston-Chippawa development. Entering private practice in 1924, and until his death in 1945, he continued to widen and extend his interests. He became chief engineer of the Grand River Conservation Commission and responsible for the design and construction of the Shand dam and related work. Later, he was consulting engineer for the extensive power developments at Shipshaw on the Saguenay River, which was vital to the production of aluminum for war purposes. Many of the provinces of Canada sought his services and he advised with respect to work in Newfoundland, South America and India.

This medal is awarded annually to the student in the Fourth Year who is registered in the course in Civil, Mechanical, or Electrical Engineering, and who obtains the highest aggregate percentage at the annual examinations of the Third and Fourth Years, provided always that the student obtains honour standing in the examinations of the Fourth Year. Receipt of the medal does not preclude a student from being granted such other award as may in the opinion of the Council be appropriate.

THE RHODES SCHOLARSHIP

The Rhodes Trustees offer for award in the Province of Ontario two out of ten of the Rhodes Scholarships for Canadians, each of the basic value of £400 a year but temporarily increased to £500. They are tenable ordinarily for two years at the University of Oxford. A third year given conditionally at Oxford or elsewhere abroad may be authorized in proper cases.

Each candidate must be a British subject with at least five years domicile in Canada and unmarried; he must have passed his nineteenth but not his twenty-fifth birthday on October 1st of the year for which he is elected; he must have completed the first year and have entered upon the second year of his course at a Canadian university at the time of application.

A candidate may apply either for the province in which he has his private home or residence, or for the province in which he has taken his university course.

In that section of the will in which he defined the general type of scholar he desired, Mr. Rhodes mentioned four groups of qualities, the first two of which he considered most important:

(1) Literary and scholastic attainments;
(2) Qualities of manhood, truth, courage, devotion to duty, sympathy kindliness, unselfishness, and fellowship;
(3) Exhibition of moral force of character and of instincts to lead and to take an interest in his fellows;
(4) Physical vigour, as shown by fondness for and success in outdoor sports.

Some definite quality of distinction, whether in intellect, character or personality, or in any combination of these, is the most important requirement. Financial need does not receive special consideration.

Forms of application and full information regarding these scholarships may be obtained from D. R. Michener, Esq., K.C., 5 Rosedale Road, Toronto 5, General Secretary for the Rhodes Scholarships in Canada or from A. B. Harvey, Esq., K.C., c/o Law Society of Upper Canada, Osgoode Hall, secretary of the Ontario Selection Committee, or from the University Registrar. Selection is made in December each year for the scholarships for the year following. Application must be made to Mr. Harvey or the appropriate provincial secretary on or before November 1st.

THE 1851 EXHIBITION SCIENCE RESEARCH SCHOLARSHIPS

The Royal Commissioners for the Exhibition of 1851 have invited the University of Toronto to recommend annually one or more candidates in order of merit for science research scholarships, each of the value of £350 per annum and ordinarily tenable for two years. The Commissioners may make a supplementary grant up to £50 per annum for University fees, etc., payable by the scholar during his tenure of the award.

Each candidate recommended must be a British subject, and under twenty-six years of age except in very special circumstances; he must have been a student of science in a university institution for a period of not less than three years and must have spent one full academic year at this University ending not more than twelve months prior to the date of recommendation.

The record of a candidate's work must indicate high promise of capacity for advancing science or its applications by original research. Evidence of this capacity, which is the main qualification for the scholarship, is strictly required. The most suitable evidence is a satisfactory account by the candidate of research work already performed, and the Commissioners will decline to consider the claims of a candidate unless such an account is furnished, or unless there is other equally distinct evidence that he possesses this qualification.

The scholar will be required to devote his whole time to research in some branch of pure or applied science at an institution in the United Kingdom or abroad, selected with the approval of the Commissioners.

The following are the departments of the University, the students of which are eligible to apply for these scholarships: 1. Bacteriology; 2. Biochemistry; 3. Botany; 4. Chemistry; 5. Engineering (chemical); 6. Engineering (civil); 7. Engineering (electrical); 8. Engineering (mechanical); 9. Engineering (metallurgical); 10. Engineering (mining); 11. Forestry; 12. Geological Sciences; 13. Physics; 14. Physiology; 15. Zoology.

A Student shall not be deemed to be ineligible because of his being on the staff of the university, if he has not been in receipt of a salary of more than $800 per annum and the nominating board may, at its discretion, recommend candidates who have been in receipt of larger salaries provided that all other conditions are fulfilled.

A student shall be deemed to be eligible in the year in which he intends to graduate, but if nominated for the scholarship his nomination shall be subject to his being successful in passing his examination for his degree.

The nominating board consists of the following members appointed by the Senate:—the Chancellor, the President, the Provost of Trinity College, Dean Beatty, Dean Innis, Dean MacFarlane, Dean Young, Dr. C. S. MacInnes and Mr. N. F. Parkinson, and the Board shall have power to call to its aid as assessor any member of the teaching staff.

Applications for these scholarships must be submitted not later than April 15th to the University Registrar from whom copies may be obtained of the general regulations of the Commissioners governing the award and tenure of the scholarship.

MCCHARLES PRIZE

This prize, the gift of the late Æneas McCharles of the value of $1,000, is awarded from time to time but not necessarily every year on the following terms and conditions: (1) to any Canadian from one end of the country to the other, and whether student or not, who invents or discovers any new and improved process for the treatment of Canadian ores or minerals of any kind, after such process has been proved to be of special merit on a practical scale; (2) or for any important discovery, invention or device by any Canadian that will lessen the dangers and loss of life in connection with the use of electricity in supplying power and light; (3) or for any marked public distinction achieved by any Canadian in scientific research in any useful practical line. The following conditions determine the method of award.

(1) The title shall be the McCharles Prize.

(2) The value of the prize shall be One Thousand Dollars ($1,000.00) in money.

(3) Every candidate for the prize shall be proposed as such in writing by some duly qualified person. A direct application for a prize shall not be considered.

(4) The composition of the awarding body shall be as follows:—
An expert in Mineralogy,
An expert in Electricity,
An expert in Physics,

and four other persons. All of the members of this body shall be nominated by the Board of Governors of the University of Toronto.

NIPISSING MINING COMPANY RESEARCH FELLOWSHIP

The Nipissing Mining Company has endowed a Research Fellowship in the Department of Mining Engineering, to be known as The Nipissing Mining Company Research Fellowship, of the annual value of the income from the fund, plus free tuition.

This Fellowship is open to graduates of any University.

H. W. PRICE RESEARCH FELLOWSHIP IN ELECTRICAL ENGINEERING

The H. W. Price Research Fellowship in Electrical Engineering consisting of the income or a part thereof but not exceeding the income for three years derived from the sum of $10,000 donated by the Hydro Electric Power Commission of Ontario, will be awarded from time to time as recommended by the School of Engineering Research, to a graduate in

Electrical Engineering of any recognized University, registered in the School of Graduate Studies, wishing to proceed with an investigation in the field of Electrical Engineering.

Forms of application may be obtained from the Secretary, School of Graduate Studies, and should be returned with a statement of qualifications not later than March 1st. The first award was available in 1943.

THE C.I.L. FELLOWSHIP IN CHEMISTRY

This Fellowship, the gift of Canadian Industries Limited, of the value of $1,000.00 is established for the encouragement of post-graduate work in Chemistry. It is open to any British subject who is a graduate of a recognized University. The holder of this Fellowship will be required to undertake research in any branch of Chemistry under the direction of the department designated by the Committee of Award. Application must be made, with full statement of qualifications and testimonials, to the Secretary of the School of Graduate Studies not later than March 1st.

T. A. RUSSELL MEMORIAL RESEARCH FELLOWSHIP

The T. A. Russell Memorial Research Fellowship in Physical Metallurgy, of the maximum value of $1,000, in the Faculty of Applied Science and Engineering will be awarded to a student registered in the School of Graduate Studies who undertakes advanced work in the field of physical metallurgy. Applications must be made to the Secretary, School of Graduate studies.

CONSOLIDATED MINING AND SMELTING COMPANY OF CANADA, LIMITED, RESEARCH FELLOWSHIP

The Consolidated Mining and Smelting Company of Canada, Limited, offers annually a Research Fellowship in the School of Graduate Studies of $750.00 for a research related to non-ferrous metals, heavy chemicals, and fertilizers. The Fellowship is known as the "Cominco Research Fellowship."

It is open to graduates in Science, Engineering, or Agriculture of a recognized university and preferably a British subject resident in Canada.

Applications for the Fellowship must be made to the Secretary of the School of Graduate Studies, not later than September 1.

CANADIAN INSTITUTE OF STEEL CONSTRUCTION RESEARCH FELLOWSHIP

This fellowship, donated by the Canadian Institute of Steel Construction, is offered to encourage scientific research in steel construction. It is open to honour graduates in engineering of any recognized university. The holder of the fellowship must be registered in the School of Graduate Studies as a student proceeding to a post-graduate degree and must carry out a programme of study and research prescribed by the School of Graduate Studies. The annual value of the fellowship is not less than $750 for a seven months term and not more than $1,200 for a ten months term.

Application should be made to the Secretary of the School of Graduate Studies not later than September 1 and should be accompanied by an official transcript of the applicant's undergraduate record, together with a statement of his engineering experience.

CANADIAN LUMBERMEN'S ASSOCIATION TIMBER RESEARCH FELLOWSHIP

This fellowship, donated by the Canadian Lumbermen's Association, is offered to encourage advanced study and research in timber engineering. It is open to graduates in engineering and graduates in forestry of any recognized university. The fellow must be registered in the School of Graduate Studies as a student proceeding to a post-graduate degree and must carry out a prescribed programme of study and research in both engineering and forestry. It is intended that the work of this programme will extend over a period of two academic years. The annual value of the fellowship is $1,000, all of which might not be granted to one student.

Application should be made to the Secretary of the School of Graduate Studies not later than September 1 and should be accompanied by an official transcript of the applicant's undergraduate record, together with a statement of his experience in the forestry and construction fields.

IMPERIAL OIL GRADUATE RESEARCH FELLOWSHIP

Imperial Oil Limited, in 1946, established for annual competition four research fellowships of the value of $3,000.00 each, ($1,000.00 per year payable in Canadian funds for a maximum of three years), open to graduates of any approved university in Canada. These fellowships are offered for graduate work leading to a Doctor's or Master's degree in the fields of Petroleum Engineering, Petroleum Geology, Chemistry or Chemical Engineering, and Mechanical Engineering. Nomination of students for these fellowships is made by the University—such nominations being submitted to the Imperial Oil Scholarship Committee, Imperial Oil Limited, 56 Church Street, Toronto, not later than June 1st, each year. Nomination forms and information as to the terms of fellowships are available at the University Registrar's office.

WALLBERG RESEARCH FELLOWSHIPS

Two Wallberg Research Fellowships of the value of $1,500 each are open to graduates of any recognized university who propose to pursue advanced study and research in any branch of Engineering in the University of Toronto.

Forms of application may be obtained from the Secretary of the School of Graduate Studies. These should be returned together with a transcript of academic record and an outline of the proposed study and research not later than March 1st.

SPRUCE FALLS POWER AND PAPER COMPANY, LIMITED, FELLOWSHIPS

The James Herbert White Fellowship in Forestry, the Robert W. Lyons Fellowship in Forestry, the Cola G. Parker Fellowship in Forestry, the

Charles H. Sage Fellowship in Applied Science, the Egerton S. Noble Fellowship in Applied Science, and the Arthur Hayes Sulzberger Fellowship in Applied Science, each the gift of the Spruce Falls Power and Paper Company, Limited, are established for the encouragement of research in the Faculties of Applied Science and Engineering and of Forestry. They are open to graduates of the University of Toronto and of other recognized universities, but are restricted to Canadian citizens.

The value of each Fellowship is up to $750. Application, together with a transcript of his academic record and an outline of the advanced study and research which he proposes to undertake, should be sent to the Secretary of the School of Graduate Studies, not later than September 1st.

ALGOMA ORE PROPERTIES LIMITED GRADUATE FELLOWSHIPS

Algoma Ore Properties Limited, Sault Ste. Marie, Ontario, has provided the funds to establish two Graduate Fellowships of a value of $2,200.00 each to be available in the Session 1950-51 or later. In awarding the fellowships, in so far as practicable, they will be given to those who have enjoyed Algoma Ore Properties Limited Undergraduate Scholarships, and who have maintained their high academic performance. They will be given only for graduate work in Mining Engineering, Metallurgical Engineering, or Mining Geology, in the University of Toronto.

THE 1940 TORONTO FUND

The 1940 Toronto Fund, the gift of Oxford University, of the value of £3000, was set up in 1940 by the parents of Oxford children who were taken into Canadian and American homes during the War. Recommendations for grants from the income from the Fund will be made from time to time by the Senate of the University of Toronto to members of the University "who wish to go to Great Britain for the purpose of study, research, or any general educational purpose, taking education in the widest possible sense." Each applicant for a grant from this Fund must submit his application to the University Registrar not later than March 1 together with an outline of the study or research which he proposes to undertake in Great Britain, or the general educational purpose which he has in mind in going there.

THE RAYMOND PRIESTLEY FELLOWSHIP

The University of Birmingham being "anxious to mark its indebtedness and its gratitude" for the hospitality shown during the Second World War to children of members of its teaching staff by members of the University of Toronto, has set aside a research fellowship to be held by a graduate of the University of Toronto. This fellowship, to be known as the Raymond Priestley Fellowship, of the value of £450 per annum as well as the cost of the return passage from Canada, is available for graduates, both men and women, preferably those who have already shown some capacity for and interest in research. The fellowship will normally be awarded for a period of three years. It is tenable in any faculty of the University of Birmingham.

The Fellow will undertake research and may, if he wishes, be a candidate for a higher degree at the University of Birmingham. The selection of the candidate will be made by the University of Toronto. The process of selection will include negotiation with the head of the department concerned in the University of Birmingham to ensure that there is in the University opportunity for the pursuit of the particular line of research required. Applications must be submitted to the University Registrar not later than March 1, together with transcripts of undergraduate and graduate records and outlines of the research to be undertaken at the University of Birmingham.

THE ROYAL INSTITUTION OF GREAT BRITAIN SCIENCE RESEARCH SCHOLARSHIPS

A scholarship of the value of £350 per annum with a possible additional allowance of £50, to be held ordinarily for a period of two years, will be offered each year to a candidate from one of the universities of Canada, Australia, New Zealand and South Africa, and is tenable only in the Davy Faraday Research Laboratory of the Royal Institution, London. No candidates will be considered except those who have been recommended for the 1851 Exhibition Science Research scholarships, and candidates who wish to be considered also for the Royal Institution scholarships are requested to state this clearly in the application for an 1851 scholarship. No other application to the Royal Institution is necessary. Copies of the regulations relating to these scholarships may be obtained from the University Registrar.

UNIVERSITY OF TORONTO GENERAL BURSARIES

The Board of Governors has established a fund to provide bursaries for deserving students who without financial assistance cannot continue their formal education. Further information may be obtained from the Secretary of the Faculty.

DOMINION-PROVINCIAL STUDENT-AID BURSARIES

Under this programme, Bursaries may be awarded to students in financial need who are resident in Ontario and who are in attendance at the University of Toronto. To be eligible, students must have obtained not less than sixty-six per cent. at their last annual examination. Further information may be obtained from the Secretary of the Faculty.

LOAN FUNDS

From the loan funds mentioned below, small loans can be made to students who are in urgent need of assistance. The funds are not large and the loans must accordingly be restricted, both in amount and number, and principally to students in the Third and Fourth Years.

Enquiries for loans from any of the following funds should be made at the office of the Secretary of the Faculty.

Engineering Society Loan Fund
Elizabeth Speller Memorial Fund
James W. Crocker Memorial Fund
Harry F. Bennett Educational Fund.

ENGINEERING SOCIETY LOAN FUND

In 1932 the Engineering Society repaid to the Board of Governors a series of annual grants which, over a period of years, had been made to the Society for special purposes. The Board of Governors, appreciating this action, set aside this sum, to be known as the Engineering Society Loan Fund, to provide loans to students of the Faculty of Applied Science and Engineering. The administration of the fund is carried out by a Committee appointed by the Board. The fund is not large, and only small loans can be made to relatively few students. Further inquiries should be made at the office of the Secretary of the Faculty.

ELIZABETH SPELLER MEMORIAL FUND

Through the generosity of Dr. F. N. Speller, of the class of 1893, the "Elizabeth Speller Memorial Fund" has been established, the annual income from which is available for loans to worthy students of the Third and Fourth Years of this Faculty. Applications for loans from this Fund should be made to the Secretary of the Faculty.

JAMES W. CROCKER MEMORIAL LOAN FUND

This fund was established by Mrs. William Crocker in memory of her son, James W. Crocker, a graduate in Mining Engineering in 1938, who was killed in an accident in a mine in the same year.

HARRY F. BENNETT EDUCATIONAL FUND

This fund was established by subscription from members of The Engineering Institute of Canada in memory of the late Harry F. Bennett, M.E.I.C., who for six years prior to his death in 1946 was chairman of the Institute's Committee on the Training and Welfare of the Young Engineer, and who accomplished so much in this field by untiring efforts.

One purpose of the fund is to make loans to deserving students who need financial assistance to enable them to study engineering sciences at university level, and who have proved themselves by successfully completing their first year in engineering or the equivalent.

Loans will be made largely on the basis of character and to men who seem likely to develop the high professional standards which are essential to leadership in engineering science. A student who has been aided by

this fund should feel that high obligations are placed on him; obligations to the subscribers, to the trustees, and to those coming after him who in turn can receive help as his loan is repaid.

Application forms may be obtained at the Faculty Office. The regulations are simple and the application of any worth-while student will be given immediate and careful attention.

SECTION XII. LIBRARIES AND LABORATORIES

THE UNIVERSITY LIBRARY

The University Library building is situated on the east side of the lawn that lies to the south of University College. It contains reading-rooms for men and for women, a law reading-room, and a medical reading-room, besides departmental studies which may be used as study rooms for honour students in the various departments in which the professors hold seminar courses, and private studies intended for advanced students engaged in research work. The University Library maintains also reserved book reading-rooms in University College and in the Economics Building.

During term the hours, except on Sundays and holidays, are:

University Library	8.45 a.m. to 10.00 p.m. (6 p.m. on Saturdays)
University College reading-room	8.45 a.m. to 10.00 p.m. (12.30 p.m. on Saturdays)
Reading Room, Economics building	9.00 a.m. to 5.00 p.m. (12.00 noon on Saturdays)

During the Summer vacation, the Library building is open from 9 a.m. to 4 p.m. (except on Saturdays and Sundays); and the two reading-rooms are closed.

Books in general demand may not be taken out of the Library until 3 p.m., when they are lent for the night to be returned by ten o'clock the following morning. On Friday afternoons, these books are lent for the week-end. Books in the main library not in general demand may, on application, be borrowed for a longer period.

Many of the departments of the University, especially those that maintain laboratories or are at some distance from the University Library, have "departmental libraries"; but these, though authorized by the Library Committee of the University, are under departmental control, and books from the main Library are transferred to them at the discretion of the Librarian of the University. The regulations governing the use of books in the departmental libraries, and the hours when they are open, are determined in each case by the department concerned, and vary greatly from one department to another. Transfer of a particular book to one of these libraries is indicated in the public catalogue in the main Library.

In the University Library students of the humanities possess an extensive laboratory. It is not only a storehouse, but a workshop in which selected materials are indexed and arranged so as to be useful. The Library does not attempt to supply textbooks; but for general and specialized reading it possesses more than half a million volumes. It subscribes to about four thousand periodicals, and is a Canadian depository for United Nations publications.

DEPARTMENTAL LIBRARIES

Periodicals and other literature in the University Library of special interest to the students of this faculty have been housed in the Electrical, Engineering, Mechanical, Mining and Wallberg Buildings for convenient reference.

These departmental libraries are situated as follows:

Applied Physics	Room 22, Engineering Bldg.
Chemical Engineering	Room 2001, Wallberg Bldg.
Civil Engineering	Room 25, Electrical Bldg.
	Room 22, Engineering Bldg.
Electrical Engineering	Room 25, Electrical Bldg.
Geological Sciences	Room 74, Mining Bldg.
Mechanical Engineering	Room 135, Mechanical Bldg.
Metallurgical Engineering	Room 37, Mining Bldg.
Mining Engineering	Room 314, Mill Bldg.

CIVIL ENGINEERING LABORATORIES

There are four main divisions comprising these laboratories, namely: Cement, Highway, Soil Mechanics, and Mechanics of Materials.

CEMENT LABORATORY

The Cement laboratory contains all the appliances necessary in making the usual physical tests on Portland cement. It is supplied with cabinets and apparatus for individual work and various shot machines designed for tension and transverse tests. In addition, the laboratory is equipped with moulds, knock-down forms for beams, drying ovens, a curing room controlled for temperature and humidity, and other apparatus required in investigating the properties of aggregates and concrete mixtures.

HIGHWAY LABORATORY

The Highway laboratory is equipped to carry out investigations in bituminous and non-bituminous materials used in highway construction and maintenance. Among the more important pieces of apparatus are the Deval abrasion, the Page Impact, and the Dorry Hardness machines, a standard brick rattler, jaw crusher, diamond core drill with rock saw and grinding lap, bituminous extractor, viscosimeters, ductility and penetration machines, cementation test apparatus, electric ovens, constant temperature baths and special equipment for the determination of the properties of subsoils.

SOIL MECHANICS LABORATORY

The Soil Mechanics laboratory is supplied with apparatus designed for the investigation of the physical properties of soils. It contains a mechanical centrifuge for determining moisture equivalents, Dow liquid limit

machines, consolidation and shear machines, Proctor compaction test apparatus, a penetration and bearing power machine, sampling tools, dispersing apparatus, hydrometers, etc., and a device for demonstrating the quicksand phenomena, permeameters.

MECHANICS OF MATERIALS LABORATORY

The Mechanics of Materials laboratory is available for the scientific and commercial testing of materials of construction such as iron, steel, timber, concrete, and masonry. The equipment includes a Riehle 400,000-lb. three screw power universal testing machine, with a capacity for beams and girders up to 28 inches in width and 16 ft. in span, and for specimens in tension and compression up to 10 feet in length, a Riehle 200,000-lb. screw power universal testing machine, taking beams 18 ft. in span, and tension and compression specimens up to 12 feet in length, a Riehle 100,000-lb. screw power universal testing machine, a Riehle 20,000-lb. screw power universal testing machine, an Olsen 20,000-lb. hand-power, wire testing machine, specially fitted for testing wooden columns with both fixed and pivoted ends, an Olsen 20,000-lb. hand-power universal testing machine, especially adapted for testing long columns, an Olsen torsion machine of 140,000 inch-pounds capacity for testing the strength and elasticity of shafts and rods up to 2 inches in diameter and 10 feeet in length; a hand-power torsion machine of simple mechanical design for testing short shafts of a maximum diameter of one inch, a Riehle 5,000-lb. transverse load testing machine for flexural tests of bars of wood and metal up to 48 inches in length, an Olsen 200-lb. tension testing machine, designed for the testing of textiles.

There are also special machines, such as an Olsen (Izod) pendulum impact machine; Brinell, scleroscope, and Firth Hardometer for hardness testing; an Avery repeated stress (fatigue) machine of the rotating beam type; proving levers and standard weights, an elastic ring, and an Amsler 60,000-lb. box, for calibrating purposes.

The accessory equipment includes Berry and Olsen strain gauges, a Nalder dividing engine, Beggs deformeter gauges, a Fereday-Palmer stress recorder—an instrument ideally suited for determining stresses in actual structure—apparatus for measuring angular deformation, a strainometer for use in determining Poisson's ratio.

In addition to the above, there are available a large number of strainometers of the usual degree of precision. These include the Bauschinger, Martens, Unwin, Ames, Riehle, Johnson, Huggenberger, De Forest scratch gauge, and other types.

MINING ENGINEERING LABORATORIES

During 1931 the building containing these laboratories was entirely rebuilt and greatly enlarged. The new building is 72 ft. x 100 ft., and is four stories high with a basement under half of it. The top floor and part

of the third are occupied by the assaying laboratories. The rest of the building is given up to the ore dressing and mining laboratories, the commodious library and study rooms, lavatory and shower baths, rooms for the staff, two rooms for research in ore dressing, a model and map room, and storerooms.

ASSAYING LABORATORY

The East and West Fire Assay laboratories occupy the top floor of the Mill Building. They are identical, with preparation, furnace, and balance rooms in sequence, while between and common to these is a supply room, and another for chemical work. This arrangement allows a natural flow of operations from sample preparation to final weighing. Equipment in general is ample to give individual work to 32 students, thus encouraging original effort and conserving time.

The grinding rooms have a Sturtevant 2 x 6 jaw crusher, a McCool 8″ eccentric plate pulverizer, buck-boards, samplers, screens, and cupel machines. A special laboratory sampler gives samples of indisputable similiarity, thus confining variations in students' assays, to their work.

Each furnace room has six Fletcher-Russell gas, and two D.F.C. oil furnaces. Parting cabinets have fan exhaust and direct illumination. Each student is allotted a work place equipped with a pulp balance, weights, tools, fluxes, and locker for individual work.

The bead balances are modern instruments by Ainsworth, Becker, Heusser, Keller, Oertling, Thompson, and Voland. Some have special rider devices and a sensitivity of 0.002 milligram. Each has independent lighting and is mounted on a cork insulated-pier.

A sample room houses a wide variety of ores, mill products, mattes, bullion, and alloys from typical mines and smelters. Thesis, service, and study rooms on the third floor provide facilities and equipment for student research. Two staff rooms are used for the determinations necessary for instructional purposes and for research. A Hoskins electric furnace with Leeds-Northrup controllers and recorder is installed here. Other equipment includes pyrometers microscope, electrolytic apparatus, and bullion rolls.

MINING LABORATORY

The Mining laboratory makes use of the ore dressing equipment as required. It is also equipped with an Ingersoll-Rand type ER-1 compressor and a variety of air driven rock drills representing the development of this machine. Blocks of synthetic ore for practising sampling and rock drilling are made up as required. A laboratory has been completed for the study of ventilation problems, air conditioning, dust counts, etc. In the main basement are bins for the accommodation of a large variety of ores from various mining districts.

ORE DRESSING LABORATORY

The main Ore Dressing laboratory, 72 ft. x 53 ft. x 22 ft. high, is equipped with the old five stamp battery with amalgamation plates,

Wilfley table, Deister Plato table, Deister slime table, an old-fashioned buddle, and classifiers. Parallel with the stamp mill is a ball mill 30 in. x 24 in., which can be used alternatively with the stamps in connection with the concentrating tables. At one side of this main laboratory is apparatus representing the complete flow-sheet of a modern concentrator designed for continuous operation at the rate of 50 to 100 lb. per hour. This plant consists of feeders, two rod mills and a ball mill each 18 in. x 12 in., with classifiers, two Wilfley tables, a Dorr type thickener, a six-cell Fahrenwald Sub A flotation unit, a conditioner, a small pilot Wilfley table, and a Genter thickener. Another laboratory, 70 ft. x 25 ft., is set aside for batch work, and contains a variety of flotation machines, small ball and rod mills, small jigs, apparatus for cyanide tests and for tests in magnetic concentration. Other rooms are set apart for hand screening, microscopes, balances, a chemical room, and a room for roasting and other high temperature testing of ores in connection with ore dressing. For further research in ore dressing, there are available, Haultain Super-panners and Infrasizers, briquetting apparatus and metal lap machines for the polishing of briquettes in the study of minerals and mill products. The laboratory is also equipped with a Panphot microscope and accessories.

The Crushing laboratory contains a Hadfield gyratory crusher, a set of rolls 16 in. x 12 in., two small Dodge crushers, two sets of miniature rolls, two disc grinders, and a dry screening machine of the Feraris type. Adjoining this room is a large room for practising sampling methods.

MECHANICAL ENGINEERING LABORATORIES

HEAT ENGINE LABORATORY

This laboratory is located on the ground floor of the Mechanical Building and comprises an experimental boiler house and a large engine room with special test-bays for internal combustion engines.

The equipment includes: three experimental boilers with stokers and auxiliaries; an injector test-rack with several injectors of different type; impulse steam turbine with hydrualic dynamometer, condensing plant and auxiliaries; reaction type steam turbine with electric dynamometer, condensing plant and auxiliaries: uniflow steam engine; large low speed steam engine with condensing plant; tandem-compound steam engine with condensing plant; two small high speed back pressure steam engines; cross-compound steam driven air compressor; low speed gas engine; medium speed compression-ignition oil engine; hot-bulb ignition two-stroke oil engine; industrial type high speed gasoline engine; two automotive type gasoline engines; automotive type compression-ignition oil engine; two variable compression engines suitable for research and testing of fuels; fuel injection spray characteristics test bench.

Prony brakes, rope brakes, hydraulic dynamometers, engine, indicators, steam calorimeters, air measuring equipment, fuel measuring equipment, exhaust gas analysis apparatus, and instruments such as gauges, thermometers, thermocouples, pyrometers, potentiometers, electric metering equipment, etc., are provided where required.

FUEL TESTING LABORATORY

This laboratory is located on the second floor of the Mechanical Building. Facilities are provided for both undergraduate and research study. The equipment includes precision balances, drying ovens, electric furnaces, a peroxide bomb calorimeter, an oxygen bomb calorimeter, flow calorimeter for gaseous fuels and flow calorimeter for liquid fuels, fuel injection spray characteristics research and test equipment, octane rating testing equipment.

HEAT TRANSFER LABORATORY

Facilities are provided for both undergraduate and research study in the several phases of heat transmission. Equipment includes 24″ and 8″ guarded hot plate apparatus and 2″, 3″, and 8″ guarded pipe apparatus for the determination of thermal conductivity, complete with full control systems; Inglis tube and shell and concentric tube industrial scale heat exchangers specially fitted for experimentation, together with their auxiliaries; a gas fired boiler system providing steam for rating tests of radiators, convectors, and similar units.

REFRIGERATION AND AIR CONDITIONING LABORATORY

This laboratory is located on the third floor of the Mechanical Building. Refrigeration equipment includes an ammonia cold storage plant, freon systems for air conditioning, deep freeze unit for temperatures to 120 degrees below zero Fahrenheit, and small demonstration refrigerators of both compression and absorption type. Air conditioning equipment includes fans of centrifugal and axial flow types, steam and water heating coils, water and refrigerant cooling coils, water spray and wet cell type air washers for humidification and dehumidification, and three systems of air ducts for the study of air flow. Also various types of heat exchangers are used with both refrigeration and air conditioning equipment.

HYDRAULIC LABORATORIES

The Hydraulic Laboratories, located in the Mechanical Building are designed and equipped to provide adequate facilities for instruction and research in all phases of fluid mechanics. The laboratories are divided into two main sections—that in which turbines, pumps, pipe flow problems, fluid measurements, etc., are carried out and a new laboratory in which open channel flow problems and similar allied subjects will be attacked.

(a) The first laboratory is located in the older wing of the Mechanical Building, occupying two floors, each of 40 ft. x 112 ft. area. In this

laboratory teaching and research are carried out in several branches of hydraulics. Among the subjects considered are the measurement of the flow of gases and liquids, friction losses in pipes and fittings, the performance of turbines, pumps, compressors and fans, with special studies such as water hammer in pipe lines and cavitation in machines.

The laboratory equipment includes five centrifugal pumps capable of supplying ten cubic feet flow per second to the laboratory supply system, a Belliss and Morcom Steam Engine driving some of these pumps, various weirs, orifices, meters, experimental pumps, a complete turbine, test stand, impulse, Francis and Kaplan turbines, glass-sided channel, measuring tanks, large scales and numerous other equipment.

(b) A new Open Channel Flow Laboratory is located in the new wing of the Mechanical Building. This laboratory occupies the whole basement of the wing and is 200 ft. long by 60 ft. wide. Water is supplied by three axial flow pumps of total capacity 9000 I.G.P.M. Through a rather novel design, all of the supply pipes are carried in trenches below the floor in such a way that water may be delivered to an experiment located in any part of the laboratory and the discharge returned to the sump through troughs also located below the floor level. Constant head conditions are maintained by a head tank having 600 feet of spillway crest. A towing channel 200 feet in length is located along one side of the laboratory equipped with a light car running on steel rails.

This laboratory is designed to permit the carrying out of model tests and all experimental and teaching work on subjects such as open channel flow, wave experiments, erosion studies, hydraulic jump studies, seepage through soils, and similar work.

MECHANICAL LABORATORY

The Mechanical Laboratory, located in the west wing of the Mechanical Building, provides facilities for experimentation in Lubrication, Bearing Friction, Efficiency of Power Drives, Static and Dynamic Stress Analysis, Speed Fluctuation and Governing, Determination of Critical Shaft Speeds, Vibration Measurement and Control, Balancing, and Fine Measurements.

The Gauge Room, air conditioned by a separate system, contains a J. & L. Optical Comparator, Sheffield External and Internal Comparators, a Brush Surface Analyser, Toolmaker's Microscopes, a P. & W. Supermicrometer, a DoAll Inspection Set, Optical Flats, sets of Gauge Blocks, thread and gear measuring equipment, and an array of micrometers, verniers, and other small tools.

The laboratory is provided with standard apparatus for A.S.T.M. tests on lubricants, and special instruments such as vibrometers, tachometers, a strain-gauge bridge, amplifiers, an oscilloscope, a stroboscope, etc. Larger equipment comprises two Olsen Static-Dynamic balancing machines, a Photoelastic Polariscope, a punch press fitted with strain gauges, two

single cylinder gasoline engines, and specially designed machines for the testing of belts, worm gear reducers, journal and antifriction bearings, and the calibration of speed measuring instruments.

INDUSTRIAL LABORATORY

The Industrial Laboratory is designed to give students some practical experience in the basic principles of Industrial Management. Problems are worked on a variety of phases of site selection and plant layout, with special emphasis on economic considerations. Experiments are performed to illustrate methods used in industry in such subjects as motion study, including micromotion study, time study, material handling, statistical quality control, training methods and training aids. There are seminar discussions on problems of Industrial Relations. The laboratory is also being equipped for post-graduate and research work.

MACHINE DESIGN LABORATORY

The Machine Design laboratory occupies about 3,600 square feet of floor space on the top floor of the new Mechanical Engineering Building with sufficient specially designed designed desk. to accommodate over 100 students at one time. This room has excellent lighting with continuous windows on three sides, two wide north-light skylights, and flourescent lights.

With convenient freight elevator service practically any type of machine or model can be moved into the Machine Design laboratory for demonstration, instruction, and study.

MACHINE AND WELDING SHOPS

These shops have a floor area of about 2,600 square feet on the ground floor and are serviced by a four ton freight elevator.

The machine shop equipment includes: engine lathes, a turret lathe, milling machines, shapers, drilling machines, grinding machines, saws, and an air compressor (supplying air to all laboratories). The machine tools have been selected to illustrate various types of individual motor drive, and the use of both mechanical and hydraulic table feeds.

The welding shop equipment includes an arc welding machine, and oxy-acetylene welding and cutting torches. The welding shop is partitioned off from the machine shop and is provided with a separate exhaust fan.

These shops have a fourfold purpose. (1) Demonstration of machine tools, machining and welding methods, and time and motion study procedures. (2) Research and post-graduate work in metal cutting and welding. (3) Construction of research and other special equipment. (4) Maintenance work for all laboratories.

CHEMICAL ENGINEERING LABORATORIES

The Wallberg Memorial Building houses the Department of Chemical Engineering. That part of the building occupied by the department has

been especially designed and equipped for the instruction of students in chemical engineering.

The general undergraduate chemical laboratories provide facilities for all engineering students taking chemical laboratory work. There are also rooms devoted to special instruction in fundamental chemical principles, many of which also find application in industrial laboratories; for example, polarimetry, the measurement of hydrogen-ion concentration, gas-analysis, calorimetry as applied to fuels, quantitative organic analysis, colorimetry. A full-time glass-blower not only makes the increasingly complex glass apparatus required for chemical work, but also gives students instruction in the elements of glass-blowing as a regular part of their course.

Research laboratories designed for occupancy by one or two students provide excellent facilities for graduates proceeding to the M.A.Sc. and Ph.D. degrees.

The chemical engineering laboratory is a room 56′ x 72′ running through two floors, the upper floor being in the form of grill-work over about half the area with an open well in the centre. This makes it possible to erect equipment of a small-scale industrial type. A travelling crane permits easy handling of heavy pieces of equipment. Off one corner of the laboratory there is an apparatus shaft 8′ x 12′ running through to the roof, with grill-work at each floor. This provides 65′ head-room for experimental work on certain types of operations that are becoming industrially important. The principal items of permanent equipment in the chemical engineering laboratory are a 24-plate experimental still, a triple-effect evaporator, a climbing-film evaporator, two plate and frame filter presses, a rotary filter, two heat exchangers, a vacuum drier, a gas-absorption tower, a crusher, a ball mill, a Werner-Pfleiderer shredder, a sulphonator, autoclaves for hydrogenation, a steam-heated evaporating pan, and general-purpose pumps and tanks. Undergraduates use nearly all this equipment as part of their course, studying, for example, the principles of distillation, gas-absorption, heat transfer, filtration; and carrying out small-scale industrial operations in this typical equipment. For example, they transform benzene into phenol by recognized procedures, and hydrogenate (i.e. "harden") a vegetable oil to a solid fat.

Apart from this general chemical engineering laboratory, which can be used for research purposes as well, there are three chemical engineering research laboratories, which consist of rooms 16′ x 21′ containing only the usual services. These will permit carrying out projects involving the construction of special equipment. There is also a room of about the same size containing 8 reinforced concrete cubicles for carrying out high-pressure work in autoclaves.

A machine shop 31′ x 17′ containing representative equipment provides the necessary machine-shop service to the chemical engineering laboratory in particular and to the department in general.

ELECTRICAL ENGINEERING LABORATORIES

The Electrical laboratories, located in the Electrical Building, are equipped for studies related to principles discussed in lecture courses rather than for routine tests.

The power services to all laboratories are 230-115 volts, direct current; 115 volts, three phase, 25 cycles; and 115 volts, three phase, 60 cycles. Power for the laboratories is supplied by the University Central Heating and Power Plant in the form of 230-115 volts, three wire, direct current. The alternating current services are supplied from two main motor-generator sets which are equipped with automatic voltage and speed regulators.

These different services, combined with a system of spare conductors, make it possible to conduct a great variety of experiments in any one of the laboratories. In all laboratories the measuring instruments are of the highest quality.

ALTERNATING CURRENT MACHINE LABORATORY

The Alternating Current Machine laboratory, located on the first floor, contains the main 25-cycle and 60-cycle service sets referred to above. Several motor generator sets are available for experiments on synchronous and induction machine. Transformers and alternating-current motors of various types; a model transmission line; a special 25-h., 22-pole, 60-cycle synchronous machine; and necessary instruments and auxiliary apparatus are available.

DIRECT CURRENT MACHINE LABORATORY

The Direct Current Machine laboratory, located on the second floor, has a 40 kw. 230 volts d.c. to 115 volts d.c. motor-generator set with Tirrill regulator for special tests. Other equipment includes a number of 5 to 10 kw. motor-generator sets for d.c. generator tests; shunt, series and compound motors with and without interpoles; and other necessary apparatus such as loading racks, rheostats, circuit breakers, prony brakes and motor starters.

ELECTRICAL MEASUREMENTS LABORATORY

The Electrical Measurements laboratory, located on the top floor, is fitted with a convenient arrangement of power supply including a very flexible storage battery service and a 1,000-cycle service in addition to the standard a.c. and d.c. services. The equipment includes galvanometers, resistance boxes, Wheatstone bridges, shunts, potentiometers, standard cells, bond testers, condensers, and such other apparatus required for making a great variety of studies in measurements by direct and alternating current methods.

COMMUNICATION LABORATORY

The Communication laboratory, located on the top floor, is equipped for setting up and measuring vacuum tube circuits of all usual types; and for measuring the properties of networks at both low and high frequencies.

Cathode ray oscillographs, harmonic analyzers, amplifiers for bridge balance, etc., are available. A 1,000-cycle supply of good wave form is located at all measuring points in the laboratory. A separate room is treated acoustically and equipped with the necessary apparatus for the study of electrical reproduction of sound.

ENGINEERING ELECTRONICS LABORATORY

The Engineering Electronics Laboratory, located on the top floor, is equipped for experiments on electronic applications in the industrial power frequency fields. The equipment includes cathode ray oscillographs of twin beam and conventional types, hot cathode rectifiers, pool cathode mercury arc rectifiers, thyratrons, ignitrons, photo-electric cells and the necessary auxiliary equipment such as power supplies, transformers, amplifiers, and measuring instruments. The equipment is so designed that circuits for the study of fundamental principles may be arranged easily and quickly. While typical commercial tubes and components are employed, they are used in such a manner as to give the greatest educational value rather than to illustrate finished commercial products.

METALLURGICAL ENGINEERING LABORATORIES

The completion of the Wallberg building permits the expansion of the Metallurgical Engineering laboratories in the Mining Building. The laboratories will now occupy some 14,000 sq. ft., which is distributed between extractive or process metallurgy, physical metallurgy and ceramics.

The extractive metallurgy laboratories are located in rooms S5 and 21 in the basement. The former houses a number of gas furnaces for melting, heat treatment, and reduction processes. The furnaces are equipped with adequate services including ventilation and automatic temperature control. An experimental foundry is to be placed in this room.

The electric furnace laboratory is housed in room 21, and is equipped as follows: A 50 H.P. motor-generator set provides 60 cycle current at various voltages between 27.5 and 550. A 200 K.v.a. transformer provides 25 cycle current at various voltages between 30 and 120. These services supply resistance furnaces of special design and also operate standard electric furnaces of arc and induction type. A 100 K.v.a. direct arc furnace and a 15 K.v.a. Detroit rocking furnace are available. Induction furnaces include 7.5 K.v.a. and 15 Kw spark oscillators (on loan from National Research Council and used for research work).

The laboratories contain outstanding equipment for conducting metallurgical reactions in vacuo or special atmospheres. This equipment is available for the production of reactive metals such as magnesium, titanium, etc.

Hydro-metallurgical equipment includes apparatus for leaching and electrolytic deposition in circulating systems.

The laboratory for metallurgical analysis is well equipped to give students training in mill and smelter methods, the analysis of furnace products, ferrous and non-ferrous alloys, and specialized ceramic bodies.

In the heat treatment and pyrometry laboratory are a number of gas and electric furnaces, type "K" L and N potentiometer, L and N Speedomax recording potentiometer, together with a number of millivolt type temperature controllers. Disappearing filament, optical and radiation pyrometers are available.

The physical metallurgy laboratories will be located on the ground and first floors of the Mining Building. Grinding and polishing rooms include standard polishing wheels and hydraulic press for specimen mounting. The metallography laboratory is equipped with a horizontal Bausch and Lomb photo-micrographic camera, desk metallurgical microscopes, and a B and L Research Metalloscope.

The laboratories also contain a "Tensometer" for making small tests, a Rockwell machine, Tulson micro hardness tester, etc.

The atomic structure of metals can be examined by means of a Phillips X-ray Diffraction Machine, which is fitted with various types of cameras (powder, back-reflection, etc.) for various uses.

The laboratory workshop is fitted with the usual machine tools and also includes welding equipment as follows: D.C. arc, oxy-acetylene, spot welder, and atomic hydrogen welder.

APPLIED PHYSICS LABORATORIES

The Applied Physics laboratories, situated in the Engineering Building, are equipped as follows:

The Photometric laboratory is equipped with precision and portable photometers for the measurement of candle-power, illumination, and brightness; integrating spheres for determining the luminous output and efficiency of lamps and luminaires; and colorimeters, spectro-photometers and flicker photometers for the measurement of colour. Standards of candle power, luminous flux, and colour temperature are maintained and a 132-volt storage battery with all electrical controls and meters necessary for precise photometry are provided.

The Illumination Design laboratory is equipped for demonstrating and measuring the performance of lighting installations.

The Optics laboratory is equipped with optical benches, etc., for the testing of lenses, and with examples of various optical instruments for instruction in their theory and applications.

The Photographic laboratory is equipped with cameras, dark rooms, and accessories for practical work in photography, and with sensitometers, spectrographs, and densitometers for the testing of photographic materials. A Zeiss phototheodolite, stereoscopes, stereocomparator, and plotting apparatus are provided for instruction in photographic surveying.

The Acoustical laboratory is equipped with the ordinary apparatus, such as forks, pipes, strings, etc., for illustrating the elementary laws of acoustics. There are also two rooms for work in sound transmission and absorption, equipped with an audio-frequency oscillator for the production of sounds of constant intensity, and microphones and amplifiers for reception.

UNIVERSITY SURVEY CAMP

In 1920 the University purchased approximately 175 acres of land comprising a tract of field, woodland, and lake front property in the County of Haliburton, and erected permanent buildings for the use of students in Civil Engineering, Mining Engineering, and Mining Geology, as well as for other students taking special work. The country is broken and rolling, and with the numerous small lakes and streams in the immediate vicinity, is admirably suited for work and the various problems that arise in practical surveying. The camp is at an elevation of about 1,000 feet above sea level and a secondary triangulation has been carried out, the stations of which are connected with the primary stations of the Geodetic Survey of Canada. Permanent bench marks have been established and connected up with the precise level net of Canada.

The Camp may be reached by the Canadian National Railways, via Lindsay to Gelert, where conveyances are always on hand to drive direct to the camp by way of Minden, a distance of 12 miles. There is also a daily bus service from Lindsay to Minden.

The Camp, located 4 miles south of Minden, on the west side of Gull Lake, can be reached by road after leaving the main Provincial highway at Minden. There are four main buildings, including a Dormitory, Administration, Staff, and Dining Hall Building, which are suitably furnished and provided with electric lighting and drafting accommodation. Accommodation for 80 students can be provided, and a large proportion of the equipment of the Department is transported to the Camp for use during the summer session.

The charge for accommodation at the 1950 camp will probably be $1.75 a day.

Mail, telegrams, or telephone messages should be addressed to "University Survey Camp, Minden, Ontario."

METROLOGICAL LABORATORY

The Department of Surveying and Geodesy is provided with all the ordinary field instruments, such as transits, levels, compasses, micrometers, sextants, planimeters, plane tables, tapes, chains, etc., with which is carried on the instruction in practical field operations as detailed elsewhere.

A small laboratory is also established in the basement of the observatory described below, containing the necessary instruments for the refined measurements of geodetic surveying; as, a standard yard and metre, a Rogers 10-foot comparator, an invar base measuring apparatus, a Kater's pendulum with vacuum chamber, a level trier, micrometer microscopes, etc.

The geodetic observatory in connection with this department is used for the instruction of students of the Fourth Year in taking observations for time, latitude, longitude, and azimuth by the precise methods used in connection with a geodetic survey. It contains a 10-inch theodolite and zenith telescope by Troughton & Simms; an astronomical transit instrument and an 8-inch theodolite by Cooke; two electro-chronographs; a Howard astronomical clock; a Dent sideral clock; a Dent sideral break-circuit chronometer; a wireless receiving instrument; arithmometers, etc.

AERODYNAMIC LABORATORY

The Aerodynamic Laboratory is fully equipped with an improved 4-ft. Royal Aircraft Establishment type wind channel, aerodynamic balance, micromanometers and other necessary instruments.

Air speeds of 80 feet per second can be secured in a stream of great steadiness and uniformity and higher speeds with some sacrifice in steadiness.

The work done in the Laboratory includes the investigation of problems in aerodynamics, tests of air craft components, and complete machines, rating of meters, ventilators, radiators, etc., and the study of the effect of wind pressure on structures, chimneys, etc.

ONTARIO DEPARTMENT OF HEALTH LABORATORY

Through the courtesy of the Provincial Department of Health, the facilities of the well-equipped experimental laboratory, which the Department operates at Stanley Park (807 Richmond Street West), have been placed at the service of the University for the investigation of problems associated with all phases of Sanitary Engineering. Equipment and means are available for study and research in the various processes employed in sewage treatment, the different methods of water treatment, and the bacteriological and chemical examinations on water, sewage, air, milk, and all factors in sanitation.

ELECTROCHEMICAL LABORATORIES

The Electrochemical laboratories, which are situated in the Mining Building, are provided with special facilities for electrolytic work, including a large storage battery and electroplating dynamo with tanks, as well as a set of apparatus and electrical measuring instruments, for both under-aduate work and research. The experimental work on electric furnaces

is carried out in a large furnace room in the basement, occupied jointly by the Department of Metallurgical Engineering and the Department of Chemistry (Electrochemistry). The equipment for this purpose comprises a 120 kw., 220 volt supply of direct current from the main power house through a switchboard, rheostats, circuit-breaker, and instruments to a set of distributing bus-bars, and a 200 k.v.a. transformer stepping down from 2,200 volts to 30-120 volts in 3 and 6 volt steps, which supplies alternating current at 25 cycles. There is a complete set of A.C. instruments, circuit-breakers, oil-switches, relays, automatic regulating winches, etc., and a Northrup high frequency furnace with its transformer is also installed. The two departments co-operate in the use of a Hoskin carbon plate furnace and a resistor tunnel furnace. Facilities for the study of high current carbon arcs and the thermal behaviour of refractories are also provided.

GEOLOGICAL LABORATORIES

The Geological laboratories are equipped for the study of geology from the modern viewpoint. Collections of rocks and minerals, models and natural specimens illustrating various geological features, topographic and geological maps for exercises in map reading, and fossils are all employed in the study of general geology. Typical index fossils are utilized, along with geological maps, in historical geology.

In the Economic Geology laboratory, numerous suites of specimens of ores and rocks illustrate the nature and occurrence of the deposits in many mining camps. A set of building stones, uncut, cut, and polished, is available for a course on that subject. These materials are studied megascopically and microscopically to determine the character and associations of their mineral constituents. The Metamorphic Geology laboratory is supplied with specimens, thin sections, and petrographic microscopes for the study of metamorphic minerals and the changes that rocks undergo in thermal and dynamic metamorphism. Hand specimens and thin sections of suites of rocks from numerous Precambrian areas are also available for work in Precambrian geology. Facilities are available for sawing and polishing specimens of ores, and rocks, and for making thin sections.

For work in structural geology, natural specimens and geological maps exhibiting complex structural conditions and structural problems illustrated by diagrams and drill logs, are extensively employed. For field methods in geology, the laboratories are supplied with geological and topographic maps, survey instruments, and various other equipment, so that work in the laboratory may supplement that in the field.

MINERALOGICAL LABORATORIES

The Mineralogical laboratories in the Mining Building provide facilities for most types of investigation involving minerals, crystals, and rocks.

Courses in laboratory work in the personal examination of type sets of named minerals, crystals, and rocks serve to illustrate the introductory lectures. More advanced work is provided in the identification of unknown minerals by physical tests, blowpipe, and other methods.

To encourage the study of pure crystallography, the laboratories are supplied with goniometers of the various types, crystal models, appliances for the cutting of oriented crystal sections and for their physical examination. Practical petrography is carried on in rooms provided with type sets of rocks, both macroscopic and microscopic. Advanced students are taught to make thin sections of rocks and polished sections of opaque minerals, and to study them microscopically.

The laboratory for the preparation of thin sections of rocks and minerals is provided with electric diamond saws and grinding appliances for the various types of work incidental to the preparation of thin sections. It is also equipped for the preparation of polished specimens for the microscopic examination of the opaque ore minerals.

The department is equipped with petrological and mineralographical microscopes, so that it is possible to provide advanced students with instruments and sets of thin sections and polished minerals for their own special use. Sets of index liquids and a universal stage are available for students interested in more advanced methods for determining the optical properties of crystals.

A well equipped X-ray laboratory, with suitable goniometers for the study of crystal structure, is available to qualified advanced students.

MUSEUM

The Royal Ontario Museum, with exhibits in Archaeology, Geology and Mineralogy, Palaeontology and Zoology, is situated at the southwest corner of Bloor Street and Queen's Park.

Students of the University in all departments are recommended to avail themselves of the privileges of the Museum.

The museum is open on Sunday from 2 p.m. to 5 p.m., and on week days from 10 a.m. to 5 p.m. with the exceptions of Monday when it is closed all day. The admission is free for the public on Tuesday, Thursday, Saturday and Sunday. On other days an admission fee of fifteen cents is charged.

By a resolution of the Board of Trustees all regular students of the University may be admitted free on showing their registration cards.

SECTION XIII. DISCIPLINE

1. (*a*) There is vested in the Council of each federated university or college, and of each faculty, disciplinary jurisdiction over and entire responsibility for the conduct of their students in respect of all matters arising or occurring in or upon their respective buildings and grounds including residences.

(*b*) Disciplinary jurisdiction in all other cases as respects all students is vested in the Caput.

(*c*) The Students' Administrative Council, in the discharge of all duties entrusted to it, will be supported in the due discharge of those duties by the disciplinary power of the Caput.

2. No student will be allowed to continue in attendance, whose presence is deemed by the Council of his college or faculty to be prejudicial to the interests of the University. The continuance of any student in attendance at a course in the University or the receipt by him of official certificates of standing or of graduation, is subject to such exercise of the disciplinary power of the Caput as may be necessary to enforce the regulations of the University and to maintain standards of personal conduct acceptable to the University. In the exercise of its disciplinary power, in the interest both of the University and of the student, the Caput will take into consideration the conduct of the student both inside and outside the University premises. In all cases an appeal to the Board of Governors may be made.

3. Students proceeding regularly to a degree are required to attend the courses of instruction and the examinations in all subjects prescribed for students of their respective standing, and no student will be permitted to remain in the University who persistently neglects academic work.

4. All interference on the part of any student with the personal liberty of another by arresting him, or summoning him to appear before any tribunal of students, or otherwise subjecting him to any indignity or personal violence, is forbidden by the Caput and by the Councils of the colleges and faculties.

5. No initiation ceremony involving personal violence, personal indignity, interference with personal liberty, or destruction of property, may be held by the students of any college or faculty of the University, under the penalty of suspension or expulsion.

6. Any reception of the students of the first year in any college or faculty must be approved by the Council of that college or faculty, but such reception must not involve any infraction of the regulations of the two preceding paragraphs.

7. The organizing of a parade in the streets of the city, or the taking part in such parade without the permission of the authorities of the city on application of the Students' Administrative Council, will be regarded as a breach of discipline.

8. The use of loud-speaking equipment in University buildings or grounds, whether stationary or moving, or whether operated by students or others, is forbidden except by permission of the Board of Governors or the Caput.

9. Any individual or individuals directly responsible for an undesirable feature in connection with any Stunt Night or other entertainment given under the auspices of a student organization will be subject to disciplinary action by the Caput.

10. A committee of staff and students appointed by the Council of the college, faculty or school concerned will provide effective supervision of the programmes of all Stunt Nights and other public entertainments and will see that the programme follows the script as approved by the Council concerned.

11. The holding of beauty contests or similar exhibitions by university students, whether under the name of the University or under the auspices of organizations recognized by the Caput, is forbidden.

12. The constitution of every university society or association of students in any college, faculty or school, and all amendments to any such constitution must be submitted to the Caput. Responsibility for the conduct and programmes of each society or association of students drawing its membership from a single college, faculty or school shall rest with the Council of the college, faculty or school concerned. Responsibility for the programmes arranged by the committees of Hart House and controlled by the Board of Stewards of Hart House shall rest with the Board of Stewards. Responsibility for the conduct and programmes of every other society or association of students shall rest with the Caput.

13. The name of the University is not to be used in connection with a publication of any kind without the permission of the Caput.

14. Students of any faculty or college on the premises of colleges or faculties other than those in which they are registered shall be subject to the regulations and penalties imposed by the administrative authorities of the premises concerned.

15. A student who is under suspension, or who has been expelled from a college or faculty or from the University, will not be admitted to the University buildings or grounds.

SECTION XIV—UNIVERSITY HEALTH SERVICE

I. *Membership:* Membership in the University Health Service is obligatory for all students, with the following exceptions:

(a) Women living in residence at Victoria College, for whom the College provides its own Health Service.

(b) Students in the Pass Course for Teachers, in the School of Law, in courses leading to the degrees of Bachelor of Science in Medicine, Bachelor of Science in Dentistry and Bachelor of Pedagogy; and certain graduate and occasional students.

Those for whom the fee is not compulsory may obtain membership in the Service on payment of the fee, provided this is done at the time of registration.

II. *Objective:* The objective is the preservation and promotion of the health of the students.

III. *Facilities:* The Health Service maintains a close liaison with the Medical Service of the Department of Veterans Affairs.

(1) Medical Examination. By order of the Board of Governors, a medical examination by the Health Service is compulsory for:

(a) Undergraduate students in their first year of attendance at the University. This examination is to be completed within one month of registration. Thereafter, the examination is to be repeated following any serious illness or accident.

(b) Any student, graduate or undergraduate, whose domicile is not in Canada. This examination is to be completed annually within one month of registration.

(c) Any student, graduate or undergraduate, where the Health Service has reason to believe that such an examination is necessary in the interest of the health of the student or of the public.

(d) Any student, graduate or undergraduate, annually, before participating in organized competitive athletics. The Health Service shall have the right to debar any student on medical grounds from participating in athletics, and also to recall any athlete for examination.

An opportunity will be afforded annually for all students to have a medical check-up if they so desire.

(2) X-Ray Chest Survey for Pulmonary Tuberculosis. By order of the Board of Governors, the following groups of students must have an x-ray examination of the chest as arranged by the Health Service:

(a) All new students.

(b) All final year students.

(c) The following students annually:
   (i) Medical students.
   (ii) Students of the School of Nursing.
   (iii) Students whose domicile is not in Canada.
(d) Dental students in their first year and last two years.
(e) Any student for whom it is considered necessary.

(3) A Clinic Service. Any student may consult a Staff Physician at the Health Service between the hours of 9 a.m. to 4.30 p.m., Monday to Friday, and 9 a.m. to 12.30 p.m. Saturday, while the University is in session.

It is essential that students should develop a sense of personal responsibility for the preservation and promotion of their own health, and if they are not enjoying good health, they are urged to consult a physician at this clinic.

(4) Athletic Injury Service. The University does not accept any responsibility for injuries sustained by students while engaged in physical education classes or in University athletic activities. However, treatment of minor conditions is provided at the Men's and Women's Health Service, and Hart House Surgery, during certain hours. See section VIII. The expense of treatment obtained outside of the Department of Health Service will be met only if approved by the Director.

(5) Health Education. The Health Service provides health education through individual consultations and at times by lectures on subjects related to the preservation and promotion of health.

For students living away from home who have not a private physician, the following services will, when available, be provided for a nominal additional charge. In the case of students on rehabilitation grants, these charges will be borne by the Department of Veterans Affairs.

(6) A Visiting Service. An initial visit only will be paid for advice and disposal. A nominal charge of $1.00 during the day (9 a.m. to 6 p.m.) and $2.00 at night (6 p.m. to 9 a.m.) is made for this visit and is payable to the Chief Accountant.

(7) An Infirmary Service. This service is for the treatment of minor illnesses only, and is available from October 1st to May 15th, and during the actual session only. A charge of $3.00 per day, payable to the Chief Accountant, is made to cover cost of meals, nursing and routine medications.

IV. *Appointments.*

(a) *Medical Examinations.* These examinations commence immediately after Labour Day in September. The examinations are by appointment only, which may be made either by telephone or in person at the Health Service offices.

The importance of keeping and being on time for the appointment as made, cannot be over-emphasized. Undergraduate students in their initial year of attendance at the University, students whose domicile is not in Canada, and all students, graduate or undergraduate, proposing to engage in athletic activities, will be examined first. The remaining years will be offered an opportunity for this examination in succession. Examinations must be completed before March 15th.

(b) *X-Ray Examination of Chest.* The Tuberculosis Survey takes place early in the Autumn Term. Arts Men students, and all women students, make their appointments in person at their respective Health Service offices. Appointments for Men students in faculties other than Arts are made through their Class President.

The *Varsity* should be carefully watched for notices relative to all appointments.

V. *Communicable Diseases.* Any student who has suffered from one of the communicable diseases must report to the Health Service prior to returning to the University.

VI. *Students Whose Domicile is not in Canada.* All such students are required to submit with their formal application, a certificate by a qualified medical practioner stating that:

(1) the student is in good health and free from contagious or infectious disease, and fit to pursue his proposed course of study at this University.

(2) In addition, an x-ray film of the chest has been made within one month of the certification, and shows no evidence of tuberculosis.

They are further warned that their registration is conditional on their passing the required health examination by the University Health Service, which includes an x-ray of the chest and which must be completed within one month of registration.

VII. *Fee:* The Health Service Fee is included in the "University Incidental Fees" and is paid at the time of registration.

VIII. *Directory:*

Directory:	*Address*	*Telephone*
Health Service (Men)	43 St. George St.	MIdway 9644
Hours Open: Monday to Friday, 9 a.m. to 5 p.m. Saturday, 9 a.m. to 1 p.m.		
Health Service (Women)	43 St. George St.	MIdway 2646
Hours Open: Monday to Friday, 9 a.m. to 5 p.m. Saturday, 9 a.m. to 1 p.m.		

N.B. This office is closed during vacation periods. At these times, general information may be obtained from Health Service (Men), and those eligible for service may make an appointment to see Dr. Frances Stewart or her substitute at her private office, by telephoning KIngsdale 7537.

Hart House Surgery	Hart House	MIdway 5838
Hours Open: Monday to Friday, 5 to 6.30 p.m. (during actual session only)		local 201
Infirmary (Men)	42 St. George St.	MIdway 3017
Open October 1st to May 15th and during the actual session only.		
Infirmary (Women)	Women's Union 79 St. George St.	KIngsdale 8163

Open October 1st to May 15th and during the actual session only. Accidents which occur after 6:30 p.m. (or 1 p.m. on Saturday), or which are of a sufficiently serious nature as to require immediate hospital attendance, should be taken:

Men: To the Emergency Department, Toronto General Hospital, College St.

Women: To the Emergency Department, Women's College Hospital, 76 Grenville St.

To obtain a physician after hours call KIngsdale 8163, if no answer, call KIngsdale 4141, and ask for the University Health Service physician.

REQUIRED PHYSICAL EDUCATION—MEN

By order of the Board of Governors each man proceeding to a Bachelor's degree must participate in the required Physical Education programme during the first and second years of his attendance at the University. The physical education requirements include a swimming test which must be taken before November 1st by all first year men and by men admitted to the second year from other Universities. Swimming classes are compulsory for all students who fail to pass the swimming test. All men required to take Physical Education must register at the Key Office in Hart House before October 15th.

The student who has neglected to complete satisfactorily attendance at the required Physical Education classes for the first or second year must take this work during the second or third year respectively of his attendance at the University, and will be required to pay an additional supplemental fee of $10.00.

The student who has failed to complete satisfactorily attendance at the required Physical Education classes prescribed for the first year will not be permitted to register in the third year. The student who has failed to complete satisfactorily attendance at the required Physical Education classes prescribed for the second year will not be permitted to register in the fourth year. Furthermore, the student who has failed to complete satisfactorily all requirements in Physical Education will not be allowed to receive the Bachelor's Degree.

All students taking part in Athletics or the required Physical Education programme must undergo a medical examination according to regulations laid down by the University Health Service. Arrangements for this examination may be made at the Health Service, 43 St. George Street, at any time after September 1st.

REQUIRED PHYSICAL EDUCATION—WOMEN

By order of the Board of Governors each woman proceeding to a Bachelor's degree must take Physical Education during the first year of her attendance at the University. Before October 2nd in the session in which Physical Education is compulsory she must register at the gymnasium office, 153 Bloor Street West, and before October 15th apply for medical examination by the University Health Service at 43 St. George Street. Swimming classes are compulsory for all students who do not pass the required swimming test. This test must be taken by October 22nd.

The student who has neglected to complete satisfactorily attendance at the required Physical Education classes for the first year must take this work during the second year of her attendance at the University, and will be required to pay an additional supplemental fee of $10.00.

The student who has failed to complete satisfactorily attendance at the required Physical Education classes prescribed for the first year will not be permitted to register in the third year.

All students taking part in Athletics or the required Physical Education programme must undergo a medical examination according to regulations laid down by the University Health Service. Arrangements for this examination may be made at the Health Service, 43 St. George Street, at any time after September 1st.

SECTION XV. HART HOUSE

Hart House, the gift of the Massey Foundation, is so called in memory of Mr. Hart Massey. This House, which is for the use of men only, is far more than a students' club. In its widest interpretation it seeks to provide for all the activities in the undergraduate's life apart from the actual work in the lecture room.

Hart House contains under one roof a dining hall, a tuck-shop where light refreshments are served, common-rooms, library, debates room, music room, a small chapel together with rooms for the use of the Student Christian Movement, an art gallery, photographic rooms, gymnasia, swimming pool, running track, rifle range, and theatre.

The House is open from 8 a.m. to 11 p.m. daily. Meals are served to students in the Great Hall from Monday to Saturday lunch. Members are entitled to full privileges of all rooms in the building between these hours and the use of the gymnasia, pool, showers and locker rooms until 9 p.m. each day except Saturday and Sunday, subject to the regulations of the Athletic Association. On Saturday the pool, and the rest of the athletic wing, closes at 5 p.m.

The Warden is entrusted with the general supervision of the whole House, but the athletic wing is under the direct control of the Athletic Directorate. In great measure the care of the House and its welfare are entrusted to the students themselves. There are a number of committees, most of which consist of ten undergraduates, three senior members, and the Warden. The undergraduates on all these committees are elected annually by the undergraduate members of Hart House. The undergraduate secretaries of five of these (House, Library, Music, Art, and Debates) together with certain appointed representatives, sit on the Board of Stewards, the governing board of the House, which is directly responsible to the Governors of the University. Of this Board the Warden is ex-officio chairman. The Comptroller, the Assistant Comptroller, the Graduate Secretary, and the Assistant to the Warden of Hart House are responsible for the administration.

All men undergraduates proceeding to a degree in the University are members of Hart House. The annual fee (September to May) is $12.00. To prevent the use of the building by unauthorized persons every member should carry his registration card and show it on request. Any member wishing to introduce a guest should obtain a card from the Warden's office.

Occasional students are not ordinarily eligible for membership in Hart House, but may make application to the Graduate Secretary's office for election by the Membership Committee.

Graduate students, graduates of this university resident in Toronto, and out of town graduates are entitled to the full privileges of Hart House when they have been duly elected and have paid the annual fee.

HART HOUSE THEATRE

Hart House Theatre is under the direct administration of the University of Toronto.

Control of the Theatre is vested in a Board of Syndics appointed by the Board of Governors. The purpose of the Theatre is the encouragement of Dramatic Art in all its aspects, particularly among the undergraduates of the University. The Theatre has a resident director and competent staff who are available for consultation and assistance. Their main activity is the production of a series of plays with all-student casts.

The Theatre was founded by the generosity of the trustees of the Massey Foundation, particularly the Right Honourable Vincent Massey and Mrs. Massey. Under the Massey Foundation and with the assistance of outstanding directors the Theatre has established an enviable reputation in Little Theatre activity throughout North America.

THE SOLDIER'S TOWER

To commemorate the sacrifice of those graduates and undergraduates of our University who gave their lives in the Great War (1914-1918), the graduates have erected the Soldiers' Tower. Situated at the southwest corner of Hart House, the Tower rises—a symbol of sacrifice—and with its screen forms a majestic link between Hart House and the old Main Building. Beneath the sheltering arches of the screen, the names of the six hundred and eighteen, to whom the memorial pays its proud and affectionate tribute, are cut deep in the stone. Above, in the belfry of the Tower, a carillon that, as it chimes, weaves a fabric of memories for professors and students who take up the tasks laid down by those who fell.

SECTION XVI. STUDENT ORGANIZATIONS

STUDENTS' ADMINISTRATIVE COUNCIL

The Students' Administrative Council is composed of the Presidents or elected heads of the official undergraduate organizations of each college and faculty of the University. The Students' Administrative Council publishes *The Varsity*, *Torontonensis* and the *Students' Handbook*. It represents the students at University functions and on public occasions and receives and administers all funds accruing from Students' Council fees, revenues from publications, and such other funds as shall become the property of the Council, and through its Secretaries it organizes such intercollegiate and university activities as may be of interest to the student body as a whole.

The Council operates an employment bureau for men and women undergraduates for summer, Christmas and part-time work. It operates a housing service for men and women undergraduates and a loan fund for men and women undergraduates in the final two years of their courses. Applications for loans must be made to the General Secretary-Treasurer of the Students' Administrative Council. The maximum loan is $100.00. A short-term emergency loan fund is available to ex-service personnel pending receipt of maintenance grants or war service gratuities.

The sale of official university jewellery, crests, and so forth, and orders for official blazers are looked after by the Council.

The University Symphony Orchestra, University Mixed Chorus and University of Toronto Band are activities of the Council in which undergraduates of the University may participate. The Council through its Radio Committee conducts courses in announcing, script writing and casting which are for undergraduates. These are under the direction of competent instructors from the C.B.C.

Through its organizations such as the Blue and White Society and the All Varsity Revue, the Council endeavours to promote a University consciousness and loyalty amongst the undergraduate body.

The annual fee paid by all undergraduates proceeding to a degree provides for a subscription to the publications of the Council to which the student is entitled and makes available to them all the services of the Council, including the loan fund for students in the first two years of their courses. The fee also covers the administration costs of the Students' Administrative Council.

The Students' Administrative Council is prepared to make to ex-service personn l emergency loans pending receipt of their entitlements under the Educational Benefits provided in the Post-discharge Re-establishment Order.

UNIVERSITY OF TORONTO ATHLETIC ASSOCIATION

By the authority of the Board of Governors University athletics for men are under the control of the University of Toronto Athletic Association of which the executive body is the Athletic Directorate consisting of:

the President of the University,
two members of the faculty, appointed by the President,
two graduates, appointed by the Athletic Advisory Board.
the Director of University Health Service, the Director of Athletics and the Financial Secretary (*ex-officio*),
five undergraduates, elected annually, from the student body,
an undergraduate representative, appointed by the Men Students' Administrative Council.

Under the authority of the Board of Governors the Athletic Directorate shall have full control of the administration of the funds of the Association, which are used in furthering the development of competitive and recreational athletics for University students.

The Directorate subject to the approval of the President is empowered by the Board of Governors to control and administer the compulsory Physical Education programme required by the Board of all men undergraduates during the first and second years of their attendance. The Directorate shall also control and administer the voluntary programme in Athletics and Physical Education available to men undergraduates of all years.

The Directorate alone has the power to sanction the use of the name "The University of Toronto" in connection with men's athletics, and no men's athletic event can be held in the University without its approval. It has full control and direction of the gymnasium, th swimming pool, the locker rooms, showers and other conveniences in connection with athletics in Hart House, the athletic fields, stadium and ice arena.

UNIVERSITY OF TORONTO WOMEN'S ATHLETIC ASSOCIATION

By the authority of the Board of Governors University athletics for women are under the control of the University of Toronto Women's Athletic Association of which the executive body is the Women's Athletic Directorate consisting of:

the President of the University,
two women members of the faculty, appointed by the President,
the Assistant Director of University Health Service in charge of Women, the Director of Physical Education for Women, and the Financial Secretary (*ex-officio*),
six women undergraduates, elected annually,
one woman undergraduate, appointed by the Students' Administrative Council.

The Directorate, subject to the approval of the President and the Physical Director for Women, is empowered by the Board of Governors to control and administer the compulsory Physical Education programme required by the Board of certain women undergraduates during the first year of their attendance. The Directorate also controls and administers the voluntary programme in Athletics and Physical Education available to women undergraduates of all years.

The Directorate alone has the power to sanction the use of the name "The University of Toronto" in connection with women's athletics, and no athletic event for women may be held in the University without its approval.

Under the authority of the Board of Governors, the Women's Athletic Directorate administers the funds of the Association which are used to further the development of competitive and recreational athletics for undergraduate women.

UNIVERSITY OF TORONTO ENGINEERING SOCIETY

The Engineering Society of the University of Toronto, being inaugurated in 1885, is the oldest undergraduate Engineering Society in Canada. Every student enrolled in the Faculty of Applied Science and Engineering is a member.

As set forth in its Constitution the objectives of the Engineering Society are:

(*a*) The encouragement of original research in Engineering.
(*b*) The preservation of the results of such research.
(*c*) The dissemination of these results among its members.
(*d*) The cultivation of the spirit of mutual assistance and cooperation among the members of the Society in the preparation for, and in the practice of, the Profession of Engineering.
(*e*) To afford an official means of communication between the student-body and the Faculty Council, the University authorities, and the students of other Faculties.

The Engineering Society consists for purposes of organization of a Federation of Clubs which may be listed as follows:

(*a*) The Civil Club of the Engineering Society, composed of the undergraduates in Civil Engineering.
(*b*) The Mining and Metallurgical Club of the Engineering Society, composed of the undergraduates in Mining Engineering, Metallurgical Engineering and Mining Geology.
(*c*) The Mechanical Club of the Engineering Society, composed of the undergraduates in Mechanical Engineering.
(*d*) The Electrical Club of the Engineering Society, composed of the undergraduates in Electrical Engineering.
(*e*) The Industrial Chemical Club of the Engineering Society composed of the undergraduates in Chemical Engineering.

(*f*) The Engineering Physics Club of the Engineering Society, composed of the undergraduates in Engineering Physics.
(*g*) The Aeronautical Club of the Engineering Society, composed of the undergraduates in Aeronautical Engineering.
(*h*) The Engineering and Business Club of the Engineering Society, composed of the undergraduates in Engineering and Business.
(*i*) The Debating Club of the Engineering Society, composed of the undergraduates in all courses

These clubs devote themselves to subjects of special interest to their members Each club holds meetings at regular intervals when papers are read and discussions of a technical nature take place. The club members have the privilege of listening to prominent men in their field and also making frequent field trips to industrial plants.

"Transactions and Year Book" is the official Society publication covering the year's activities. The "Toike Oike Quarterly" is the literary publication of the Society.

The Society also maintains a Supply Department which carries all student supplies with the exception of text books. Profits from the store are used to subsidize the Engineering Society's social functions.

FACULTY OF APPLIED SCIENCE ATHLETIC ASSOCIATION

Affiliated with the Engineering Society is the Faculty of Applied Science Athletic Association.

The Athletic Association has full control over all athletic clubs using the name of the Faculty of Applied Science. The Executive Committee has power to suspend anyone from the privileges of membership in the Association for any breach of its regulations, and controls the finances of all athletic clubs in the aforesaid Faculty. The annual membership fee of this Association is two dollars.

No other moneys are collected for the support of athletics in the Faculty of Applied Science without the sanction of the Executive Committee.

STUDENT CHRISTIAN MOVEMENT

The Student Christian Movement in the University of Toronto is part of an international fellowship of students in the colleges and universities of the world, the World's Student Christian Federation. Based on the conviction that in Jesus Christ are to be found the supreme revelation of God and the means to the full realization of life, the Movement seeks through a programme of study, prayer and practice to understand the Christian faith and to live the Christian life by uniting in its fellowship all students who share its basic convictions as well as those who wish to test their truth.

Among the methods employed by the Movement in seeking to realize its purpose are study groups, worship services, forum discussions, confer-

ences, lectures, work projects, and social services in the down-town district. Of special interest to Engineering students are the "Student-in-Industry" camps which are carried on during the summer vacation periods in industrial communities.

The programme is open to all interested students. It is not necessary to "join" in order to share in the activities of the Movement. On the Toronto campus full information may be obtained from S.C.M. executive members in the various colleges, the names of whom will be found in the *Students' Handbook*, or from the S.C.M. offices in Hart House and the Household Science Building.

UNIVERSITY OF TORONTO
UNIVERSITY NAVAL TRAINING DIVISION

The University Naval Training Division course has been instituted by the Royal Canadian Navy to provide an opportunity for suitable young men in Canadian universities to perform officer's training while they are undergraduates and prepare themselves thereby for promotion to commissioned rank in the R.C.N. or R.C.N.(R) on graduation.

Men who are accepted are entered at first in the lowest rating of the branch for which they apply. If they pass a selection board which takes place before 1st February of their first academic year, they are advanced to the rank of Cadet R.C.N.(R). On graduation a successful cadet may be promoted to either Acting Sub-Lieutenant, R.C.N., or Sub-Lieutenant, R.C.N.(R).

(a) Students in Electrical Engineering, Engineering Physics, Mathematics and Business are entered as Electrician's Mates, 2/c (U.N.T.D.).
(b) Students in Engineering other than courses listed in (a) are entered as Stokers II (U.N.T.D.).
(c) Students in Medicine are entered as Sick Berth Probationers.
(d) Students in Arts, Commerce, Law, or Business Administration who elect to enter the Supply and Secretariat Branch are entered as Writer Probationers (U.N.T.D.).
(e) (i) Students in any course not mentioned in (a), (b), or (c),
or
(ii) Students in Engineering, but who have not decided at the time of entry upon their particular Engineering courses;
(iii) Students listed in (d) who do not select the Supply and Secretariat Branch are entered as Ordinary Seamen (U.N.T.D.).
(f) Pre-medical students are entered as Ordinary Seamen (U.N.T.D.).

U.N.T.D. men are given a minimum of sixty hours' training during the academic year. They must do two full summer vacation periods of training at the coast and a minimum of two weeks' training during other summers. Summer training consists of cruises at sea and courses in schools ashore.

Until promoted to the rank of Cadet R.C.N.(R), U.N.T.D. men wear uniforms similar to those of seamen in the Royal Canadian Navy, thereafter they wear special cadet uniforms.

U.N.T.D. members are paid training allowance for attendance at Divisional Drills performed during the academic year. The total training allowance paid during an academic year for a man or cadet shall not exceed sixteen days' pay at $58 per month for the first year men, $69 per month for second year men, for Cadets R.C.N.(R) $143 per month. During summer training periods the monthly rates of pay for U.N.T.D. members are as follows:

	Naval Training	Voluntary Service
First year U.N.T.D. course (men)	$ 58	$ 69
Second year U.N.T.D. course (men)	69	78
All cadets R.C.N.(R)	143	143

Students in the U.N.T.D., University of Toronto, are part complement of H.M.C.S. "York", and their administration, training, and discipline are under the jurisdiction of the Commanding Officer, H.M.C.S. "York".
Area Commanding Officer .... Captain F. R. Base, R.C.N.(R)
Commanding Officer .... Lieutenant-Commander R. F. McRae, R.C.N.(R)

UNIVERSITY OF TORONTO CONTINGENT CANADIAN OFFICERS TRAINING CORPS

In view of the record of the officers who received their training in the COTC before and during the war, the Director of Military Training at Canadian Army Headquarters has stated that this Corps is now looked upon as the chief source of officers for the Canadian Army.

A student who completes his training in the COTC is granted a commission as a lieutenant in the Canadian Army upon graduation and may join the Active Force (permanent army), if vacancies are available, or the Reserve Force. He is, however, under no obligation to do so but may remain on the Supplementary Reserve (inactive list).

Training is organized into two portions:

(a) Practical training, twelve to sixteen weeks each summer at Active Force Schools.

(b) Theoretical training, lecture courses during two academic sessions; not more than forty lectures per year.

Pay during the summer is $143 per month, and for those completing each theoretical lecture course, an additional ten days' pay. During summer training, board, lodging, clothing and transportation from home or University to Corps Schools and return, are all provided free of charge.

To be eligible, students must be eighteen to twenty-two years of age, British subjects, physically fit, and following a course of study leading to a University degree. Exceptions as to age are made in cases where a student was in one of the services during the war.

Arrangements have been made so that summer training may be accepted in part for the summer practical work required in certain faculties and courses.

Application for training should be made in person before the 20th of October to Contingent Headquarters, 119 St. George Street, Toronto. Previous experience has been that many more applications are received than can be accepted. Early application is advisable.

The Contingent Staff is:

Honorary Colonel	Colonel H. J. Cody, C.M.G., E.D.
Commanding Officer	Lieutenant-Colonel W. L. Sagar
Second-in-Command	Major L. S. Lauchland, E.D.
Adjutant	Captain J. H. Potts
Resident Staff Officer	Major H. W. F. Appleton, E.D., s.c.
Assistant Resident Staff Officer	Major G. MacLean Logan, p.s.c.

ROYAL CANADIAN AIR FORCE (AUXILIARY) UNIVERSITY FLIGHT (TORONTO)

In 1948-1949 a University Flight of the RCAF was established at the University of Toronto. Initially this Flight was organized as a university detachment of 400 Squadron—a Toronto-based fighter squadron of the RCAF (Auxiliary); but it is probable that the Flight will eventually be organized as a University Reserve Training Unit of the RCAF Reserve.

The function of the University Flight is to foster interest in the RCAF and furnish a flow of trained university students into the Regular, Auxiliary and Reserve Air Force. Its original establishment provided placement for 100 students, comprising:

(1) Students who already had one or two of three consecutive summers of aircrew training in the RCAF; and

(2) Students desiring training for post-graduate appointments in one of the three components of the RCAF—i.e., Regular, Auxiliary or Reserve.

It is expected that at the commencement of the academic session 1949-1950 there will be not less than 35 vacancies in the University Flight, these being reserved for men of classes due to graduate from the University of Toronto in 1953, 1954 or 1955. Students selected for these vacancies are to be appointed to the rank of Flight Cadet—a comparatively new officer rank, which may be thought of as that of an officer cadet. Before appointment as Flight Cadets, students are required to sign an undertaking that upon completion of their service in the Flight they will remain in the RCAF (Auxiliary) or at their own option transfer to either the RCAF (Regular) or the RCAF (Reserve).

While serving as members of the University Flight, students are given "winter training" consisting largely of lectures during, normally, three successive academic years. Their three sessions of winter training are each immediately followed by a period of "summer training". In the case of

Flight Cadets selected for aircrew, this training consists of spending three summers in qualifying as pilots, navigators, or radio officers. In the case of Flight Cadets selected for other training, this consists of contact training at appropriate RCAF units during summer months of three successive years. For winter training, the pay allowed each University Flight Cadet is approximately $25 in his first year, and $50 in each of his second and third years. For summer training his entitlement, ordinarily for a period of approximately four months, is $153 per month plus rations and quarters valued at $55 per month. These rates of remuneration are supplemented by certain extra allowances for those Flight Cadets who participate in winter or summer flying training.

The RCAF Orderly Room at the University of Toronto is located at 119 St. George Street and serves as a focal point not only for affairs of the University Flight but also for other interests of students in the RCAF. In this Orderly Room, ex-aircrew students who desire to participate in the Veterans Summer Employment Plan of the RCAF may file applications; and members of graduating classes (and other interested students) may obtain information regarding full-time service in the RCAF (Regular), and file applications for appointment to such service.

In the session 1948-1949 the staff of the RCAF on the campus of the University of Toronto was as follows:

University Air Liaison Officers—W/C T. R. Loudon, VD, RCAF (Reserve)
—S/L F. L. Hutchison, RCAF (Auxiliary)

RCAF (Regular) Liaison Officer
—F/L M. A. Everard, RCAF (Regular)

Clerk —LAC R. J. Stringer, RCAF (Regular)

Officer Commanding RCAF (Auxiliary) University Flight (Toronto)
—S/L F. L. Hutchison, RCAF (Auxiliary)

UNIVERSITY ADVISORY BUREAU

The University Advisory Bureau seeks to make its own contribution to the life of the University by providing within the University a neutral zone where the student may discuss in freedom and in confidence personal matters of the most fundamental importance to his successful development as a student, as a worker, as a citizen and as a fully effective person.

In keeping with this objective, the Bureau performs the following functions:—

(a) Through liaison with the University departments, the Registrars' offices and appropriate services on the campus, the Bureau furnishes information and assistance in the financial, educational and personal spheres. The Bureau, for instance, serves as a focal centre for applications to The Veteran-Students' Loan Fund and provides information on other loan facilities, including Navy, Army and Air Force Benevolent Trust Funds. Working with appropriate Registrars' offices, the Bureau helps the student

to clarify details regarding entrance requirements, courses of study and related occupational goals. The Bureau is also available for consultation on personal questions involving adjustment to University life, assessment of interests, vocational direction and other matters of a similar nature; where advisable, students are referred to more specialized services.

(b) Liaison with D.V.A. The Bureau works closely with the Department of Veterans Affairs, both locally and with Ottawa headquarters, on all matters affecting the interests of ex-service students and in many ways serves as a campus clearing house for problems which might otherwise require to be referred to the Toronto office of D.V.A.

(c) Liaison with other universities. In contact with the Advisory Bureaus located at other Universities across Canada, the Bureau seeks to maintain up-to-date information on local variations in all fields significant to ex-service students—entrance requirements and application deadlines, courses available, length of training, degrees awarded, etc.

The personnel consultants associated with the Bureau have for the most part seen service in the late war and have been associated with the Personnel or Rehabilitation Directorates of the Navy, Army or Air Force.

The Bureau is located at 67 St. George Street.

SECTION XVII. LODGING AND BOARD

HOUSING SERVICE FOR STUDENTS

For students who are not accommodated in the University and College residences, the Students' Administration Council prepares annually a list of inspected and approved rooming houses, flats, partments and homes. This list may be consulted at the Housing office in Hart House after August 1st and throughout the session.

To meet the housing shortage in Toronto, the Students' Administrative Council has greatly expanded its Housing Service. Every effort is being made to provid accommodation for married ex-service students and for those who have children. Information may be obtained from the Students' Administrative Council's Housing Service office, Hart House.

Through this service many opportunities have been afforded students, including those students who are married to obtain lodging and board in exchange for part-time services. Students desiring this type of accommodation are asked to indicate this when they apply.

RESIDENCE FOR MEN

Through the generosity of the late E. C. Whitney, Esq., Mrs. Whitney, and friends, the University offers to approximately two hundred men the advantages of residential life within its own grounds. The Residence consists of three Houses: South, East and North.

Occupants are required to pay their residence dues in three instalments, the first instalment of $60.00 on or before the opening day of the session, the second instalment of $50.00 by November 20th, and the third instalment of $23.00 by February 20th.

Except under very special circumstances, occupants will be required to remain in the Residence for the full academic session. Occupants who obtain permission to withdraw will be required to give two weeks' notice and to forfeit their deposits.

Applications for rooms must be submitt d to the Secretary of the Residence Committee, Registrar's Office, Simcoe Hall. Forms for this purpose will be supplied on request. As early as possible the summer preceding attendance at the University, each successful applicant will be notified of his assignment. He must then send to the Secretary of the Residence Committee a deposit of $5.00. On receipt of this he will be sent an assignment card. Cheques or money orders must be made payable to the University of Toronto. The deposit will be returned if the applicant is not admitted, but will be forfeited if written notice of non-acceptance of a room assigned is not received by the Secretary before September 15th. On request the deposit will be refunded in full at the end of the college year if the room key is returned and the room and furniture left in a satisfactory condition.

The University lays down three general rules designed to prevent hazing, gambling, and the use of intoxicants.

A circular giving further information may be obtained from the Secretary of the Residence Committee.

SUMMARY OF STUDENTS IN ATTENDANCE

Session 1948-49

Year	Course 1	2	3	5	6	7	8	8a	9	10	11	Total
I....	94	15	97	37	91	86	13	5	14	23	50	525
II....	180	21	233	46	124	185	22	13	31	35	85	975
III....	166	32	273	86	168	207	39	8	32	65	87	1163
IV....	159	51	231	79	150	219	33	11	46	55	97	1131
	599	119	834	248	533	697	107	37	123	178	319	3794
						West Indies Surveyors.......						5
						Total......................						3799

SECTION XVIII. THE ENGINEERING ALUMNI ASSOCIATION

This calendar presents in outline the courses offered in the Faculty of Applied Science and Engineering, as well as an indication of opportunities which are open to undergraduates for a broadening of their interests by participation in the extra-curricular activities of the Faculty and University.

After spending a few years under the stimulating and maturing influence of college life it is natural that students should, after graduation, feel a desire to preserve the friendships formed in undergraduate days, and should seek to extend the opportunity for further interest and service on behalf of Faculty and Alma Mater.

Many Engineering graduates, who recall their college days with pleasure and a sense of indebtedness, have felt this desire which has found expression in the formation of the Engineering Alumni Association. With succeeding years of mellowing traditions and fresh infusions of new members annually, it has grown in enthusiasm as well as in size. Each graduating class appoints its own permanent executive, thus retaining its identity and through the inspiration and leadership of the Engineering Alumni Association all find a common bond of loyalty to "School" and its traditions, and a friendly contact with their fellows.

Every three years a reunion of "School" graduates is held to bring them together for a renewal of old associations with classmates and with staff. Between times the Association carries on its work through its Council. The extent of these activities is well exemplified by naming such Council committees as Membership, Scholarship, Class Organizations, Undergraduate Relations, Engineering Education, Reunions, Publicity, and Federation Affairs. Certain members of the Council are constituted as a Junior Panel and maintain close relations with the more recent graduates, while the inclusion of the President of the Engineering Society on the Council ensures liaison with the undergraduate body.

The Engineering Alumni Association serves in the wide sphere of University graduate activities through its membership in the Alumni Federation of the University of Toronto, which was formed from seventeen associations representing various Colleges, Faculties, and Departments in the University. The Federation co-ordinates the activity of all the Associations and edits and publishes the *University of Toronto Monthly*, which contains news items and articles of interest to all graduates. Through Class, Association and Federation the bond is complete and "School" men take pride in the extent to which they have contributed of their counsel and support on such matters as the University and the Faculty may wish to consult the graduate body.

All "School" graduates, and students who have had at least one year in the Faculty of Applied Science and Engineering, are members of the

Engineering Alumni Association and the Alumni Federation; but only those paying the prescribed annual fee of three dollars are entitled to vote, hold office, or exercise the rights and privileges of membership and to receive the *University of Toronto Monthly.* This fee is distributed—one dollar to the engineering Alumni Association for the maintenance of its activities, and two dollars to the Alumni Federation towards a share of its administrative expenses and for clerical work on behalf of the Association, and to cover the members' subscription to the *University of Toronto Monthly.*

APPENDIX I. GRADUATE STUDIES

Graduates interested in pursuing courses for post-graduate degrees should send inquiries to the Secretary of the School of Graduate Studies.

The University is prepared to offer graduate courses in all of the Departments of the Faculty of Applied Science and Engineering. The degrees offered are M.A.Sc., and Ph.D. These courses are open to graduates of this University or of another University of comparable standing. Candidates must have a sufficiently good undergraduate record in a course closely related to the one they propose to follow.

Various Fellowships, Bursaries, and Scholarships are available to graduate students as shown in the table on page 145. In time of peace many part-time demonstratorships are open which permit graduate work towards a degree. In normal times, also, research assistants are appointed annually on salary in the School of Engineering Research, and this work may be counted as a partial fulfilment of the requirements for a graduate degree.

One full academic year of study is required for the degree of M.A.Sc. and a minimum of three years for the degree of Ph.D. Part-time work must total to these full-time requirements. To be eligible to receive the degree of Ph.D. the candidate must make an original contribution to knowledge.

REGULATIONS FOR DEGREES

MASTER OF APPLIED SCIENCE

The regulations governing the Degree of Master of Applied Science (M.A.Sc.) shall be determined as follows:

1. A candidate for the degree of Master of Applied Science shall hold the degree of Bachelor of Applied Science of this University or a degree from some other university recognized as equivalent by the Council of the School of Graduate Studies.

2. A candidate wishing to proceed to a graduate degree shall (*a*) register with the Secretary of the School of Graduate Studies at the beginning of the academic year, (*b*) enrol in one of the courses mentioned in Clause 4. As a condition of registration as a candidate proceeding to a degree, he must submit evidence that the department concerned is willing to enrol him.

3. Not later than November 1, 1949, he shall submit to the Secretary for acceptance by the Council of the School of Graduate Studies the title of his proposed thesis as approved by the department concerned.

4. Not later than May 15, 1950, he shall present evidence to the Council of the School of Graduate Studies that he has spent not less than one academic year in the course concerned as a student enrolled in one of the following courses on a course of study approved by the department: Civil Engineering, Mining Engineering, Mechanical Engineering, Engineering Physics, Chemical Engineering, Electrical Engineering, Metallurgical Engineering, Mining Geology, Aeronautical Engineering.

5. Not later than May 15, 1950, vidence that the candidate has satisfactorily met all the requirements of the department with regard to thesis and to such examinations as the department shall require, shall be forwarded to the Council of the School of Graduate Studies through the sub-committee administering the regulations governing the degree of Master of Applied Science.

DOCTOR OF PHILOSOPHY

Graduates of the Faculty of Applied Science and Engineering may proceed to the degree of Doctor of Philosophy. Information as to the conditions to be met by candidates for this degree is to be found in the Calendar of the School of Graduate Studies, which may be obtained from the Registrar of the University. The degree is an academic degree, not a professional one, and the research work and courses leading to the degree are primarily concerned with the fundamentals and underlying principles of the sciences. In general, a candidate selects one major and two minor subjects for study, the research being carried out in the major subject. A period of three years is usually required for the fulfilment of the requirements for the degree. However, it should be understood that the degree is not granted for the passing of prescribed courses or for the performance of prescribed laboratory work for a period of three years. The laboratory research work must have led to results of a high order, constituting a real contribution to the science of the major subject, and the candidate must have attained a decided maturity of knowledge and outlook before he may present himself for final examination by the Committee of the School of Graduate Studies. A graduate proposing to proceed to this degree should consult, in the first instance, with the members of the staff in the department in which he proposes to take his major subject.

PROFESSIONAL DEGREES

CIVIL ENGINEER, MINING ENGINEER, MECHANICAL ENGINEER, ELECTRICAL ENGINEER, CHEMICAL ENGINEER, METALLURGICAL ENGINEER

The regulations governing the Professional Degrees of Civil Engineer (C.E.), Mining Engineer (M.E.), Mechanical Engineer (Mech.E.), Electrical Engineer (E.E.), Chemical Engineer (Chem.E.), Metallurgical Engineer (Met.E.), for the session 1949-50 shall be determined as follows:

1. A candidate for one of the said degrees shall hold the diploma of the School of Practical Science or of the Faculty of Applied Science and Engineering or the degree of Bachelor of Applied Science, or shall have spent not less than two years as a member of the teaching staff in this Faculty after having graduated in engineering from another institution of recognized reputation.

2. He shall have spent at least three years after receiving the diploma or the degree in the actual practice of the branch of engineering wherein he is a candidate for a degree.

3. Intervals of non-employment, or of employment in other branches of engineering, shall not be included in the above three years. It shall not be necessary that the several periods requisite to make up the said three years be consecutive.

4. The candidate shall obtain from the Secretary of the School of Graduate Studies the regular application form which, properly filled out, accompanied by the designated evidence of professional experience and by the title and synopsis of the proposed thesis, shall be delivered to the Secretary not later than the first day of November.

The evidence of professional experience shall fully describe the kind and extent of all work undertaken by the candidate since the date of graduation up to the time of application, indicating clearly the degree of responsibility for such work. Certificates from present and past employers shall accompany the application. The names and addresses of not less than five engineers to whom the candidate is personally known and who have knowledge of his professional activities shall be submitted.

5. The application and the subject of the thesis are subject to the approval of the Board of Examiners, who may satisfy themselves by oral or written examination in regard to the candidate's experience and competence in engineering works.

6. The candidate after notification of the approval of the Board shall prepare an original engineering thesis in the branch in which he has applied for a degree. This thesis shall be on work in which the candidate has had actual experience and shall preferably be in the form of an engineer's report on the design of engineering works, or on processes, and accompanied by all necessary descriptions, details, drawings, bills of materials, specifications and estimates. (Note that a thesis of a solely descriptive type will not be acceptable.)

7. The thesis, with accompanying papers, described in clause 6, shall be sent to the Secretary not later than the first day of March.

8. The candidate may be required to present himself for examination in the month of March or April at such time as may be arranged by the Examiners.

9. The thesis, drawings and other papers submitted under clause 7, shall become the property of the University.

10. Nothing in these regulations shall prevent any candidate from receiving more than one of the said degrees, provided he has the necessary qualifications for each degree. An interval of three years must elapse between the granting of any two degrees under these regulations.

HIGH SCHOOL ASSISTANTS' CERTIFICATES, TYPES A AND B

The Department of Education of Ontario has agreed to accept the degree of Bachelor of Applied Science as fulfilling the academic require-

ment for admission to the course for a High School Assistants' Certificate in the Ontario College of Education.

HIGH SCHOOL ASSISTANTS' CERTIFICATES, TYPE A

By an agreement between the University of Toronto and the Department of Education of Ontario, persons holding the degree of Bachelor of Applied Science may, by taking certain prescribed courses in the Faculty of Arts, complete the academic requirements for admission to the qualifying examination for courses leading to High School Assistants' Certificates, Type A, in (*a*) Mathematics and Physics and (*b*) Science, at the Ontario College of Education. Information regarding these prescribed courses may be obtained from a pamphlet issued by the Registrar of the University, from whom copies may be had on application. Each person who desires to complete these academic requirements should communicate directly with the Registrar in order that his case may be considered and his particular conditions defined.

The Department of Education has approved of the acceptance of the degree in Applied Science in the Course in Engineering Physics, with standing of at least 66% at the final examination, as covering the academic requirements for admission to the qualifying examination for the course leading to High School Assistants' Certificates, Type A, in Mathematics and Physics at the Ontario College of Education.

ONTARIO LAND SURVEYORS AND DOMINION LAND SURVEYORS

Examinations are held, usually in February of each year, for the following:

Preliminary Dominion Land Surveyors
Leveller's Examination
Final Dominion Land Surveyors
Ontario Land Surveyors

Any student of the Faculty of Applied Science and Engineering is eligible for these examinations, but graduates in Civil and Mining Engineering are allowed a shortened apprenticeship before writing their final examinations. Full information respecting above examinations may be obtained from the staff in Surveying and Geodesy.

GRADUATES ENROLLED IN THE FACULTY OF APPLIED SCIENCE AND ENGINEERING

Civil Engineering	16
Mechanical Engineering	14
Chemical Engineering	15
Electrical Engineering	20
Metallurgical Engineering	5
Ceramic Engineering	1
Mining Geology	5
Aeronautical Engineering	10
Total	86

INDEX

Administrative Officers........ 7
Admission, Qualifications and Procedure for........ 25
Advisory Bureau........ 207
Aerodynamic Laboratory........ 188
Aeronautical Engineering........31, 72, 78
Alternating Current Machine Laboratory........ 184
Alumni Association........ 211
Annual Examinations........ 142
Applied Mathematics........ 126
Applied Mechanics........ 79
Applied Physics........ 84
Applied Physics Laboratories........ 186
Assaying........ 87
Assaying Laboratory........ 178
Astronomy........ 91
Athletic Association........201, 203
Attendance, Summary of Students in........210, 216

Bachelor Degrees........ 31
Botany........ 91
Bursaries........ 144
Business Administration........ 98

Calendar........ 5
Canadian Officers' Training Corps........ 205
Cement Laboratory........ 176
Ceramics........ 128
Ceramic Engineering........31, 64
Chemical Engineering........31, 53, 92
Chemical Engineering Laboratories........ 182
Chemistry........ 92
Civil Engineering........31, 36, 91
Civil Engineering Laboratories........ 176
Commencement........ 6
Communication Laboratory........ 184
Conduct of Students........ 191
Constitution, Student Societies........ 200
Courses........ 31
Courses, Graduating........31, 34
Curriculum........ 34

Degrees........ 31
    Bachelor........ 31
    Master........31, 213
    Professional........31, 214
    Ph.D........31, 214
Departmental Libraries........ 176
Department of Health Laboratory........ 188
Deposits........ 29
Descriptive Geometry........ 95
Design of Structures........ 79

Direct Current Machine Laboratory . . . 184
Discipline . . . 191
Dominion Land Surveyors . . . 216
Drawing . . . 95

Economics . . . 98
Electrical Engineering . . . 31, 57, 102
Electrical Engineering Laboratories . . . 184
Electrical Measurements Laboratory . . . 184
Electricity . . . 49, 50
Electrochemical Laboratories . . . 188
Engineering Alumni Association . . . 211
Engineering and Business . . . 31, 75
Engineering Problems and Drawing . . . 95
Engineering Physics . . . 31, 47
Engineering Research, School of . . . 33
Engineering Society . . . 202
English . . . 131
Examinations . . . 142
Excursions . . . 35
Ex-Service Personnel . . . 143
Extra-Curricular Activities . . . 143

Fees . . . 29
Fellowships . . . 144
Fluid Mechanics . . . 116
Fuel Testing Laboratory . . . 180

Geodesy . . . 91
Geological Laboratories . . . 189
Geology . . . 110
Geological Sciences . . . 110, 129
Geophysics . . . 49, 52
German . . . 131
Graduate Studies . . . 213
Graduating Courses . . . 31, 34

Hart House . . . 198
Heat Engine Laboratory . . . 179
Heat Engines . . . 113
Heat Transfer Laboratory . . . 180
High School Assistants' Certificates . . . 215
Highway Laboratory . . . 176
Historical Sketch . . . 23
History . . . 98
Holidays . . . 5
Hydraulic Laboratory . . . 180
Hydraulics . . . 116

Illumination and Acoustics . . . 49, 51
Industrial Laboratory . . . 182
Inquiries . . . 25, 33

Laboratories . . . 175
Languages . . . 131
Law . . . 98
Lecture and Laboratory Subjects . . . 78
Libraries . . . 175

Loan Funds 172
Lodging and Board 209

Machine Design Laboratory 182
Machinery 119
Masters Degrees 213
Mathematics 123, 126
Mechanical Engineering 31, 44
Mechanical Engineering Laboratories 179
Mechanics 79
Mechanics of Materials Laboratory 177
Meetings, Engineering Society 5
Medals 144
Metallurgy 126
Metallurgical Engineering 31, 61
Metallurgical Engineering Laboratories 185
Metrological Laboratory 187
Mineralogical Laboratories 189
Mineralogy 129
Mining 87
Mining Engineering 31, 40
Mining Geology 31, 68
Mining Engineering Laboratories 177
Modern Languages 131
Municipal Engineering 91
Museum, Royal Ontario 190

Naval Training Division, University 204

Officers, Administrative 7
Officers' Training Corps, Canadian 205
Ontario Department of Health Laboratory 188
Ontario Land Surveyors 216
Ore Dressing 87
Ore Dressing Laboratory 178

Petrography 129
Ph.D 31, 214
Photographic Laboratory 186
Physical Education 26, 131, 196
Physics, Applied 84
Physics 131
Practical Experience 135
Professional Degrees 31, 214
Prizes 144

Refrigeration Laboratory 180
Registration 25, 27
Research Assistants 33
Research, School of Engineering 33
Residences 209
Royal Canadian Air Force 206

Sanitary Engineering Laboratory 188
School of Engineering Research 33
School of Graduate Studies 213
Scholarships 144

Shop Work....44, 136
Sickness.... 142
Soil Mechanics Laboratory.... 176
Soldiers' Tower.... 199
Specialists' Certificates.... 215
Spectroscopy....49, 50
Staff, Teaching.... 8
Structures, Design of.... 79
Student Christian Movement.... 203
Students' Administrative Council.... 200
Student Organizations.... 200
Supplemental Examinations.... 143
Summary of Students in Attendance....210, 216
Surveying.... 137
Survey Camp....5, 138, 187

Teachers' Certificates.... 215
Term Examinations.... 143
Theatre, Hart House.... 199
Thesis.... 139

University Advisory Bureau.... 207
University Health Service.... 193
University Naval Training Division.... 204
University Survey Camp.... 187

Vaccination.... 28

X-Rays and Spectroscopy....49, 50